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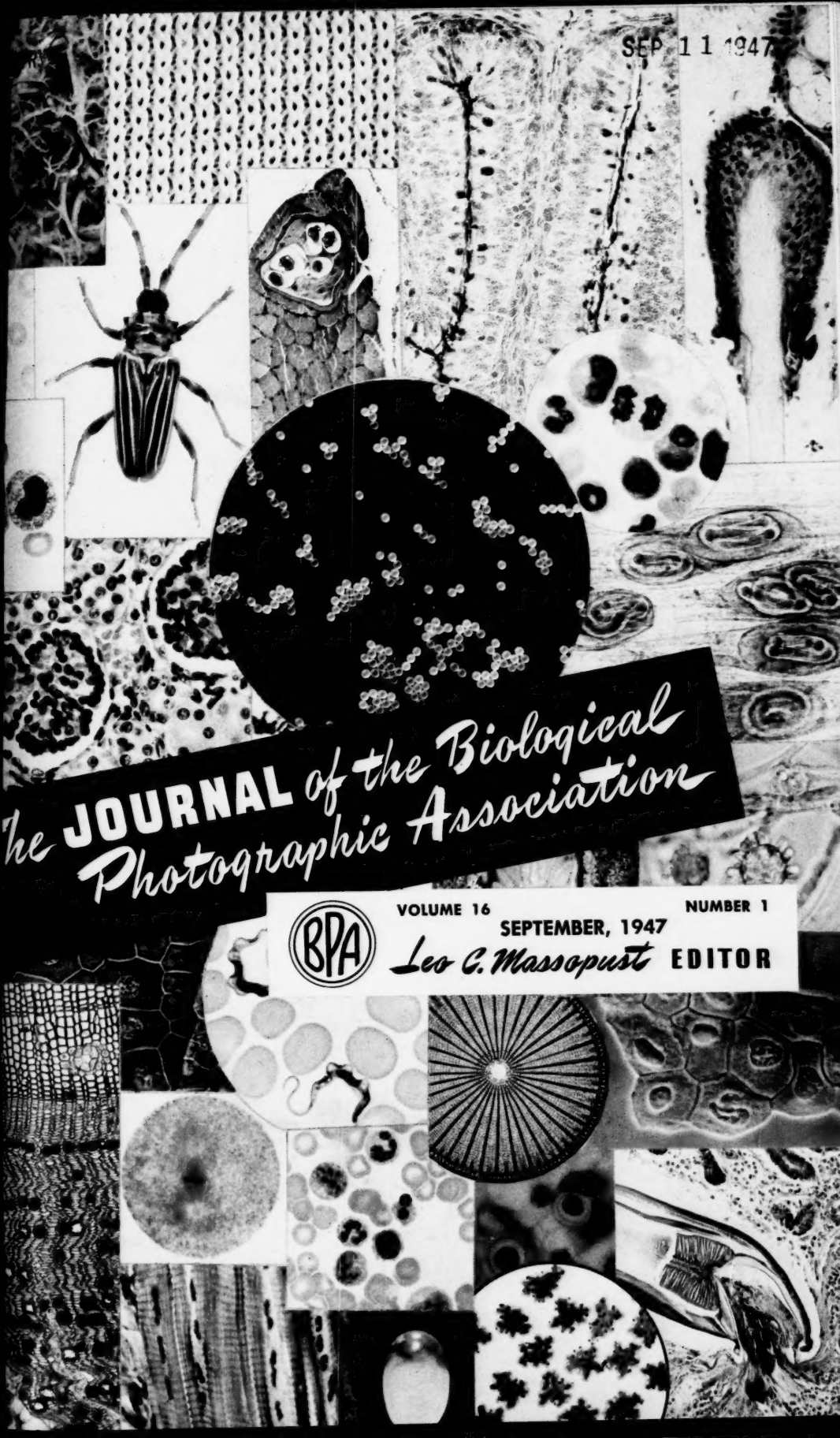

The JOURNAL of the Biological Photographic Association

VOLUME 16 NUMBER 1
SEPTEMBER, 1947
Leo C. Massopust EDITOR

1947 Convention

Biological Photographic Association

The 1947 Convention of the Biological Photographic Association will shortly be in session—September 10-13, 1947. It is believed that an excellent program has been provided and a majority of papers scheduled to be presented are listed at the end of this text. Upon going to press, the time and day for the presentation of each paper had not been finally decided.

All meetings of the Convention will be held in the Auditorium located on the third floor of the Rundel Building of the Rochester Public Library, South Avenue and Court Street, Rochester, New York.

The Convention Headquarters are at Hotel Seneca. Undoubtedly, most of you who plan to attend the Convention have already returned to the Hotel Seneca the necessary reservation card that was sent to you with the Summer Bulletin. However, it may be necessary for those who cannot secure the reservations they desire at the Seneca, to go to some other hotel. The Powers Hotel, the Rochester Hotel, the Sheraton Hotel, Knights of Columbus and Y.M.C.A. can provide accommodations by writing them as to your requirements.

The International Exhibition of Biological Photography, which was judged on August 10, demonstrated some exceedingly fine representations of the biological photographic art. The Exhibition, we feel, will not only be a splendid pictorial survey of the biological field but will offer many ideas of technics to employ in making comparable photographs. You may be assured that some outstanding examples of photography will be on display. The Exhibition will be hung in the Gallery on the second floor of the Rundel Building.

Registration at the Convention will begin at 12 noon on Wednesday, September 10. Registration facilities for the meeting will be available on the third floor of the Rundel Building opposite the Auditorium. Copies of the Program and the Catalogue of the Exhibition will be distributed there to all registrants. Luncheon and Banquet tickets will be on sale at the time of registration. It is suggested that inquiry as to location of the Rundel Building be made at the desk of the Hotel Seneca.

Two trips to industrial plants have been arranged. The Bausch & Lomb Optical Company has arranged a very informative trip through the various departments of their factory that have interest for the biological photographer. A trip has also been scheduled to Kodak Park of the Eastman Kodak Company, where various phases in the

(Continued on Page 46)

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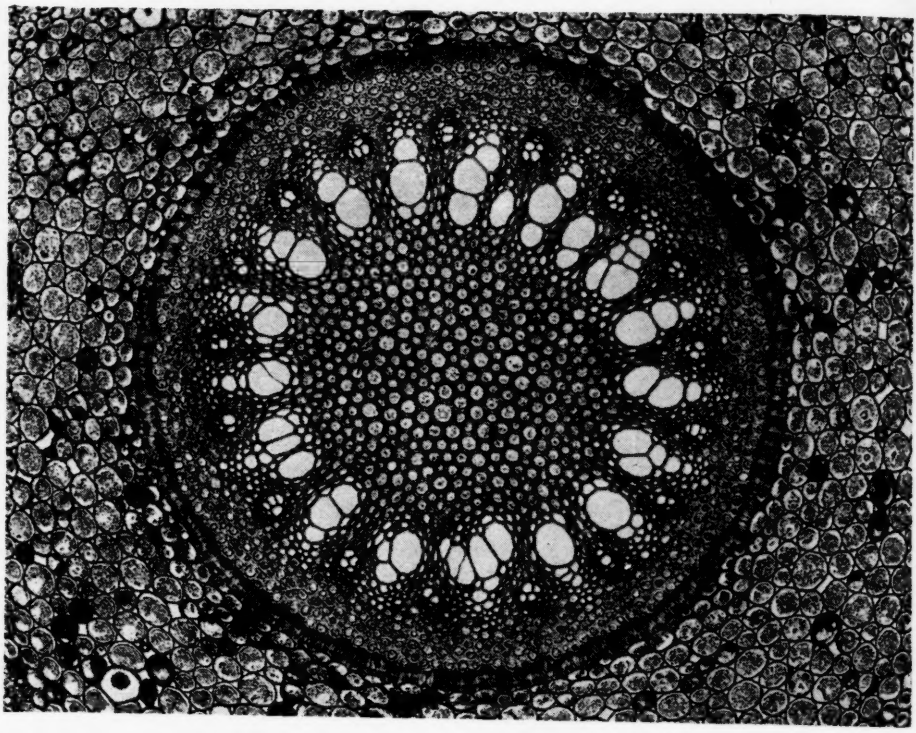

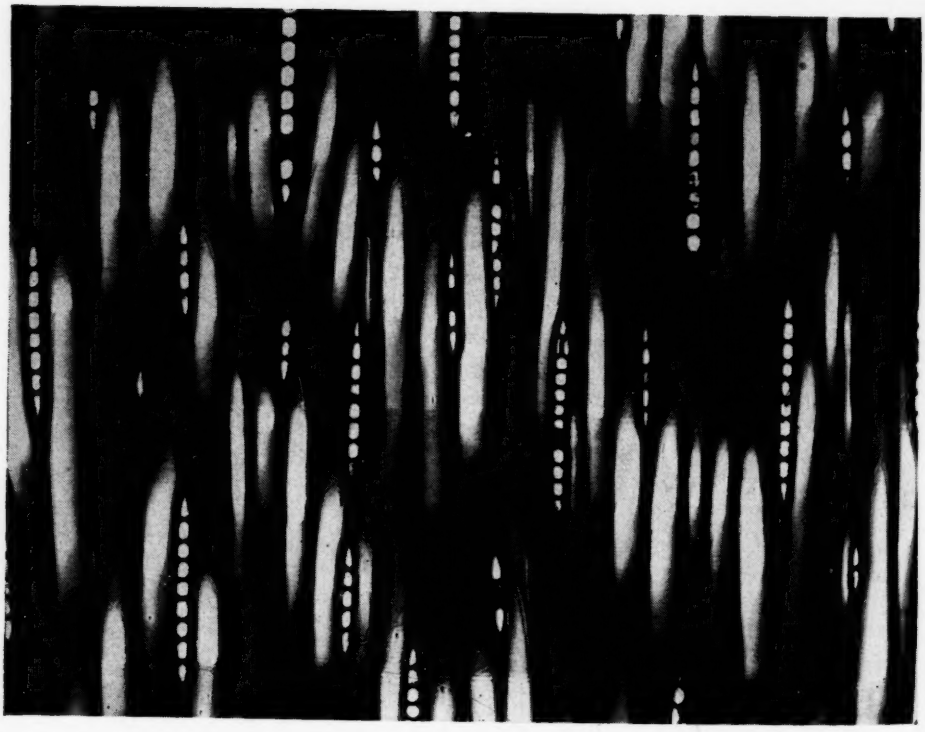

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A Motion Picture of Models of Motile Bacteria*

Adrianus Pijper, M.D., D.Sc., F.B.P.A.

Why the Motion Picture was Made

STUDIES of motility and agglutination of motile bacteria, published partly in this journal (1940, 1942), partly elsewhere (1930, 1931, 1938, 1941, 1941a, 1946), made me conclude that the traditional conception of bacterial motility is erroneous. Motile bacteria are not moved by motile organs, called flagella. Motile bacteria move because of the spiral contortions of their bodies, which produce a gyrating undulating movement. During active life, long motile bacteria are not "rod-shaped" but appear as spirals, and the shorter forms as sections of a spiral. "Bacteria" therefore is a misnomer, inapplicable to motile bacteria. After death, in *rigor mortis,* many motile bacteria seem to be rod-shaped, and so the name "bacteria", which means "rods", arose. Yet under *post mortem* conditions, even when aggravated as they usually are by fixing and staining processes, the original spiral shape can often be distinguished. Descriptions of such bacteria, frequently mention a slight curve, unwittingly suggesting a spiral.

Bacteria carry a mucous coat, probably chiefly consisting of polysaccharides. The gyrating undulating (spiral) movement of the body spins this material into a tail, which is dragged along by the body. This was noticed, photographed and filmed by me (1930-1946) by means of *sunlight* darkground microscopy. Recently I have also seen it in darkground with a 100 CP Pointlite *lamp,* by suspending bacteria in methylcellulose solution (1947), which slightly thickens the tail.

This spun mucous material which forms the tail, in sunlight darkground can occasionally be seen to untwist into a number of wavy threads which for a time surround the bacterial body, and then float away (1938, 1946). The process called "flagellar staining" can make those wavy mucous threads visible in dead fixed preparations. They are then called "bacterial flagella". "Flagellum" means motor-organ.

* Received for publication June 4, 1947 from the Institute for Pathology, University of Pretoria, South Africa.

These wavy threads are not flagella but just mucous twirls, the product of motility, not its cause (1946, 1947).

To demonstrate these revolutionary views, a motion picture is being assembled. It is largely cinemicrographic and will be described in detail later. Part of it is made from models of bacteria, complete with tails and mucous twirls. This part of the problem is dealt with here. By using moving models the new theory can be presented quickly and clearly. Working with models has numerous advantages. One is that phenomena can be made clear by drawing out the incidents in space or time or both.

Technique of making models

At first I thought I could reach my aim by making an animated film from drawings. This was abandoned because it meant too many repetitive drawings. Spiral movement means that the same phases recur periodically. Each time a bacterial body has completed one full revolution, it has moved a distance equal to its own length, and the whole movement is then repeated. Figure 1 (top) illustrates so to speak the ideal shape, just one spiral, and with it is a longer form comprising two spirals. One complete forward revolution of the left-hand half of the double spiral will bring it over the line "A" into the position of the righthand half. The first and last and all the intermediate stages would have to be drawn and repeated for every revolution if drawings were used. To obtain depth they would have to be made with great care, Figure 2. This repetitive work was avoided by making a number of models, each of them representing one stage in a complete revolution, and photographing these: prints could then be produced in sufficient number for as many revolutions as necessary. For filming purposes, one complete revolution was regarded as a series of 16 stages. Filming the 16 models repeatedly in appropriate order and position as single frames and then projecting them, would create the illusion of continuous spiral movement.

The 16 models were made of plasticine and then painted black with India ink. For each one a weighed quantity of plasticine was rolled out into a cylinder with round ends. This was then wound around a suitable cylindrical object, twice resulting in the shape of the tight coil in Figure 3. By evenly pulling out this structure as indicated by Figure 3, the double spiral shape of Figure 3 was reached.

Figure 1. Top left. Figure 2. Top right. Figure 3. Center left. Figure 4. Center right. Figures 5-20. 16 stages in the sequence of shapes assumed by the bacteria.

In this way 16 double spirals were first made. Each of them was then in turn placed alongside the basic model depicted in Figure 4. The numbers on the side of this picture indicate the 16 different stages. As an example stage 6 is especially indicated in Figure 4. From each one of the 16 double spirals a single spiral was then cut off to correspond with one of the 16 stages, each one representing one stage in the orderly sequence of shapes assumed by the undulating and gyrating bacteria.

Filming the Models

The 16 models thus acquired were then photographed with a Kontax camera, under identical lighting conditions. This resulted in 16 negatives, of which prints are shown in Figures 5-20. The actual models were 16 centimeters long, while on the negatives they measured 32 millimeters. Prints were made without enlargement, on matt paper. The bodies of the bacteria were then carefully cut out from every print along their outlines, thus eliminating the backgrounds. These prints are further referred to as "naked bacteria" and are illustrated in Figures 21-36. They still show depth although the shadows cast by them have been cut away.

For the motion picture a Movikon camera was used with lens attachment, altered so as to take pictures at 2½ feet distance, covering a field of approximately 11½ by 8½ inches. Several hundred sheets of white paper of this size were cut, and a wooden frame was made with a suitable recess into which these pieces fitted snugly. Camera and frame were placed on a short optical bench, which was tilted in order to keep the sheets of paper in place through gravity. Light was provided by two 200 watt lamps in suitable reflectors 2 feet from the frame.

Filming movements of "naked bacteria"

The first motion picture was of movement of the "naked bacteria" made as follows: A thin pencil line was drawn across 128 sheets of paper, from the lefthand bottom to the righthand top. The sheets were numbered, and on sheet 1 a "naked bacterium" of stage 1, (Figure 21) was pasted over the pencil line at the lefthand bottom. As each complete revolution of the bacterium was to occupy a distance of 32 mm., the "naked bacteria" being of that length, a "naked bacterium" of stage 2 (Figure 22) was pasted on sheet 2 along the pencil line two millimeters further on. In this way the first 16 sheets each got one "naked bacterium", each successive one placed two millimeters further along the pencil line. With sheet 17 a new revolution was

started, repeating the whole series of 16 stages, always proceeding 2 millimeters at a time. To cover the full distance across the field 8 revolutions were needed, constituting 128 prints. All the sheets were then placed in orderly sequence in the wooden frame, and filmed, each sheet getting one exposure. The results were quite good, the film when projected showed beautiful gyrating undulating movement, with an obvious three-dimensional effect in space.

Motile bacteria never swim along a straight line, their course always is a curve. This is understandable because one cannot assume that the regularity of the spiral contortions of the body can ever be perfect, and a slight deviation from absolute regularity must result in a deflection from a straight course. The presence of a tail, providing a streamlined shape, steadies movement which explains why the circle may be a very large one.

Motile bacteria have the capacity of suddenly reversing the direction of the spiral contortion of their bodies. When this is done during a period of relatively slow speed, the result is that the bacterium suddenly starts moving in the opposite direction. If it is done during a period of high speed, the momentum drives the bacterium on in the same direction in which it was going, but the tail end suddenly becomes the front end. In simple words the bacterium executes a semi-somersault but maintains its course. The mechanism of the two happenings is the same, a sudden reverse of the spiral occurs. It is difficult to analyse these phenomena when seen under the microscope, and therefore an effort was made to illustrate them with models.

A bacterium was made to appear to swim a certain distance across the field, using the models exactly as described above. After a certain number of revolutions had been performed, and stage 16 had again been reached, the whole series of 16 models was employed again, but they were all turned around so that they faced the other way. They were all then pasted on the same spot in successive sheets. This was done to make it clear that although the bacterium had reversed its spiral movement and intended going in the opposite direction, its original momentum would keep it on the spot for a while. After this complete revolution had thus taken place *in loco,* a number of sheets followed each carrying a "naked bacterium", all facing in the new direction, and each one placed 2 mm. further along the pencil line, so that movement would now appear to take place in the opposite direction. On projection, this section of the film produced the required effect, the bacterium seemed to hesitate while it reversed the direction of its spiral movement, and then swam away in the opposite direction.

To illustrate the "semi-somersault" by means of the models, a bacterium was again made to appear to swim a certain distance across the field. To give the impression of greater speed, alternate models only were used. This meant that instead of the usual sequence of stages 1, 2, 3 etc., this time stages 1, 3, 5 etc. were used, taking care that each stage was placed not 2 mm., but 4 mm. further along the line of movement. When after a few revolutions stage 15 was reached, a number of sheets followed on which at exactly the same spot where stage 15 had been, all the 16 stages had been stuck on, but in such a way that the bacterial body seemed to pivot around a point in the middle of its body. This meant that the two ends of the bacterial body circumscribed an arc of 180 degrees, and the front end became the rear end. After these sheets a number of sheets were used on which the "naked bacterium" was made to appear moving along in the original direction. Alternate stages again were used, each stage 4 mm. further than its predecessor to preserve the impression of high speed. The projected film made it appear that the bacterium did reverse its direction of spiral movement but that it was in such a hurry that it just performed a semi-somersault and then went on its original course.

Filming Models with Appendages

The next step was the introduction of tails. The new theory of motility assumes that the live protoplasm throws the bacterial body through the thin tough cell wall into spiral contortions which produce the gyrating undulating movement. The formation of a tail from the mucous (polysaccharide) covering was illustrated by means of the models as follows. Following the usual pencil line on a number of sheets of paper, a number of "naked bacteria" were again pasted on, in the same way as for the first section of the film described above. This required eight complete revolutions or 128 pictures of models. This time however mucous coats were drawn round the "naked bacteria" with a red grease pencil. Red grease pencil was chosen because it would show up rather black, but not so black as the deep shadows on the bacterial body. Also, the greasy nature of the pencil would prevent the mucous coat from looking too well defined on the outside, thus giving a more natural picture. The first 16 stages just carried this rather thick coat (Figure 37). During the following revolutions the illusion had to be created that the mucous coat, through the gyrat-

Figures 21-36. Left, prints referred to as "naked bacteria". Figures 37-38. Top right. Figure 39. Final stage of revolutionary process. Figure 40. Splitting of bacterial tail. Figure 41. Bottom right.

ing undulating forward movement of the body, would flow toward the rear and there take the shape of a spiral tail being dragged behind the body. This was done by gradually extending the mucous coat beyond the rear end of the bacterium. Figure 38 shows an early stage in this process, Figure 39 the final stage. Altogether five complete revolutions had to be run through before the tail arrived at its final stage. This was then continued for another three complete revolutions. Care had to be taken that the tail during its formation and after its establishment, conformed to the shape of the bacterium and appeared to follow its movement. This required a certain amount of calculation and judgment, but by keeping the tail within a definite length, and by making the length of its waves the same as those of the body, this was achieved. All the sheets were then put through the usual filming process, and the resulting film very definitely gave the illusion of a mass of mucous, first lying inertly around the bacterial body, and then becoming drawn out into a wavy tail, which followed the undulating gyrating movement. No "shading" of the tail appeared necessary, the bacterial body gave such a good impression of depth that the tail seemed to rotate in space and not just to undulate.

In the sunlight darkground microscope I have often seen a bacterial tail split, usually into two wavy threads, sometimes into three. These splits can reunite and then the bacterium can swim as before. The temporary presence of two "tails" does not always interfere much with motility. Occasionally however it happens that the tail untwists itself into a large number of fine wavy threads which later come off and float away. It is these fine wavy threads which sometimes can be found in specially stained bacterial preparations and which have given rise to the erroneous conception that motile bacteria possess flagella. This phenomenon is difficult to film, and so far I have not succeeded in doing it, for the fine wavy threads are too thin to photograph on a moving film. Still pictures are occasionally possible (1938, 1946). The method of illustrating happenings by means of models therefore was exceedingly useful for illustrating this phenomenon. It was done by placing a naked bacterial model in the center of a number of paper sheets, always at exactly the same spot. It was then, on sheet 1, provided with a tail, so that it looked like Figure 39. On the following sheets the bacterial body was first made to stretch into a flatter spiral and the tail to get shorter and then shown to be gradually splitting, going from the stage of Figure 39 to the stage of Figure 40. To illustrate reuniting, it was only necessary to film the sheets on which splitting had taken place, in the reverse order. They were then put through again

in their normal order. The next step was to illustrate the further untwisting into a large number of wavy threads. This was done by making a series of drawings, always around the bacterium lying still in the center of the field, in which the two tail-like structures of Figure 40 gradually split further into thinner wavy threads, until through Figure 41, the stage of Figure 42 was reached. Care was always taken that nothing was ever displaced more than 2 millimeters in two successive drawings. When Figure 42 was reached, a further series of drawings was added, in which the thin wavy threads gradually floated away from the bacterial body. The ultimate stage is shown in Figure 43. All these sheets were then filmed in the usual manner, and the resulting film gave the perfect illusion that the tail of a bacterium was gradually breaking up into a number of wavy threads. Incidentally Figure 42 is a good illustration of the usual stained picture of "peritrichous flagella".

Finally, an effort was made to illustrate what happens to the tail during sudden reverses and semi-somersaults. Under the microscope these events take place so rapidly that they are difficult to follow. For this purpose the sheets which had served to illustrate these movements with "naked bacteria" were used, but this time tails were drawn in with red grease pencil.

For a sudden reverse, a bacterium was made to traverse the field, swinging a normal tail at the rear end of its body (Figure 39). During the stationary period, when the body remained at the same spot, while executing its reversed gyrating undulating movement, the tail was gradually made shorter until it was about half its normal length. This is just what happens under the microscope when forward movement stops suddenly. On the following sheets, on which the bacterium was still shown revolving on the spot in the opposite direction from where it came, the shortened tail was moved up a little each time, along the side of the bacterial body, until it reached what had been the front, but which had now become the rear end. In Figure 44 it is shown half way to its destination, in Figure 45, it is nearly there. This is actually what happens under the microscope at high speed, and again shows that the tail is just a string of mucous material, which floats quite easily, and is entirely passive where bacterial movement is concerned. During a sudden reverse it merely obeys the laws of simple mechanics, its impetus moves it to the other end of the bacterium. After this, a number of sheets were added, on which the bacterium moved in the new direction, followed by an ever lengthening tail, again obeying the laws of simple mechanics. When projected this series of pictures showed exactly what was expected, a fast moving bacterium which as it were,

suddenly changed its mind, swung around its tail, and then went off in the opposite direction.

For a semi-somersault, the "naked bacteria" going through this performance as detailed above, were provided with a normal tail (Figure 39) for the first few revolutions. As soon as the bacterial body started spinning around a point in the center of its body, the tail was made to slide along the side of the body on its way to the other end. Figure 46 shows the bacterium when its poles have gone through an angle of about 45 degrees, in Figure 47 they have just passed 90 degrees, in Figure 48 the new position has nearly been reached. As in real life this movement is performed very rapidly; the tail remained of the same length all the time, it is just inertly waiting to go on in the old direction. This was shown by the following sheets where the bacterium went on in the old direction, with merely its poles reversed. On projection this part of the film also very efficiently illustrated what actually takes place. The bacterium gave the impression of moving freely inside its mucous coat, and performing its semi-somersault quite independently of the movements of its mucous tail.

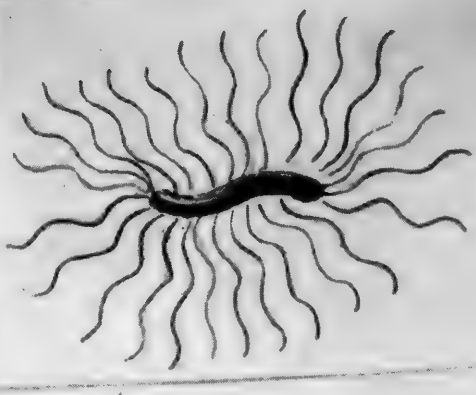
Summary

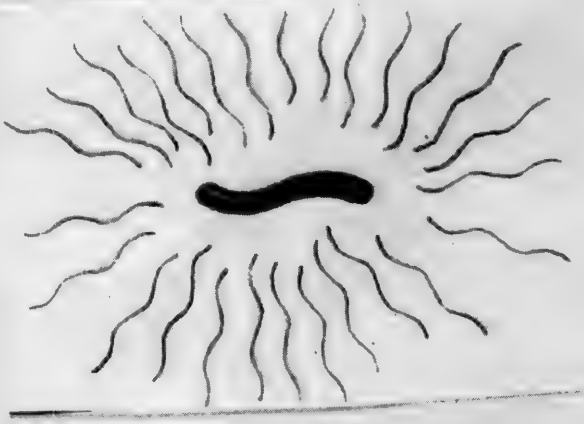
An animated motion picture has been made to illustrate the author's thesis that motile bacteria swim by means of spiral contortions of their bodies, which produce a gyrating undulating movement, and that so-called bacterial flagella are not motor organs, but just mucous twirls which are formed and can be twisted off from the mucous coat by the gyrating undulating movement of the bacterial body.

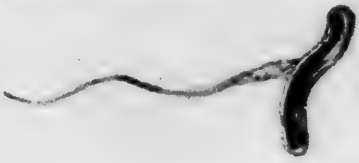
For this purpose 16 models were made of plasticine, each one copying a stage of one complete revolution of a bacterial body. Small size photographs of these models were printed in large numbers on matt paper, and the pictures of the bacterial bodies were then cut out from the prints. These "naked bacteria" were then used for purposes of animation. They were stuck on sheets of white paper in various orders and sequences and the sheets of poper were then filmed in the usual manner by single exposures.

In this way it proved possible to produce a motion picture which showed not only simple forward movement by means of gyration and undulation, but also sudden reverses and semi-somersaults. The film

Figure 42. Top right. Tail-like structures split into wavy threads. Figure 43. Threads separated from the body. Figure 44. Top right. Tail shown half way to its destination. Figure 45. Tail shown near its destination. Figure 46. Bacterium with poles at 45° angle. Figure 47. Bacterium with poles at 90° angle. Figure 48. New position of the bacterium.







very definitely gave the illusion of three-dimensional gyrating and undulating movement in space.

The same pictures of models were further used to illustrate the behavior of the mucous coat surrounding bacteria. The mucous coat pencilled around the naked bodies was shown to become drawn out into a tail by the very movement of the body. Furthermore the tail was shown to consist of a number of thin wavy threads, into which it is seen to split, thus creating the erroneous impression of peritrichous flagella. Finally, the behaviour of the tail during sudden reverses and semi-somersaults was illustrated by further pencil drawing around the bacterial bodies.

The motion picture thus made is intended to form part of a much larger cinemicrographic film of motile bacteria moving in darkfield, which film deals with the same subject on a larger scale and which is now nearing completion.

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New Journal Cover

An attractive new cover, consisting of a composite of photomicrographs, begins with this first issue of volume 16 of the Journal. The cover is the result of the generous contributions of the following members of the BPA:

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High Speed X-Ray Motion Picture Studies*

Irving Rehman, Ph.D.

Introduction

Many attempts have been made to develop a practical method of Roentgen cinematography since the discovery of the x-ray by Roentgen in 1895. The advantages of roentgen cinematography or cinefluorography in recording action, transient phenomena, physiologic activity and pathologic conditions have been readily apparent to the scientist in research and to the clinician for diagnostic purposes. However, many obstacles lay in the path of this desired goal.

Within two years of the discovery of the x-ray Macintyre ('97) had prepared a synthetic motion picture of approximately 40 feet showing the hind leg of a frog in motion. His method actually consisted of a form of animation in that a series of x-rays of the frog's hind leg were rearranged in different positions and photographed. He was followed by Levy-Dorn ('05) who employed the same procedure and prepared a synthetic film of the movements of the knee and elbow joints. Jarre and Cummings ('30) developed the direct method further, using a film five inches wide and exposed at intervals ranging between one-half to one second. Alvarez ('30) also prepared 4 x 5 inch films at a faster rate—i.e., four to six per second in strips 30 feet long. Barclay ('35-45) also employed the direct method in obtaining 5 x 5 inch films at speeds of three to four per second with a possible, although not practical, maximum of eight exposures per second. Stewart and Chiselim ('37) and Stewart ('38) in this country were the first to employ the indirect method and obtain films at normal or near normal speeds of 16 exposures per second. Their non-synchronous method depended upon a very fast lens (Zeiss R. Biotar f. 85) and an extremely powerful full-wave rectified x-ray set and tube. Reynolds ('38) faced with the everpresent problem of decreasing the radiation dosage of the subject in indirect cinefluorography developed an apparatus designed to act as a synchronizing switch that would permit

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the x-ray tube to generate rays at the exact instant that the camera shutter is open. Exposures were produced at the rate of seven pictures for each revolution of the driving spindle. Franklin and Janker ('36, '37) using a direct method were able to obtain pictures at the rate of 17 exposures per second. However these were limited to small objects only. The work of Gauer ('44) in Germany did not modify the picture in that only 16 frames per second were attempted but only four or five were properly exposed. As may be seen, although these methods resulted in adequately exposed films with safety to the subject, relatively slow speeds were necessary.

Several methods of recording the x-ray or fluoroscopic images were explored. Of these the direct and indirect methods are most suitable. These two methods differ widely in that the direct method records the x-ray image in full size directly upon moving x-ray sensitized film; whereas the indirect method consists of photographing the images on the fluorescent screen. Both methods have their limitations.

The limiting factors in the direct method are primarily mechanical and electrical in nature so that this method could be applied to small subjects only. This method necessitates a specially arranged film transporting mechanism designed to move a large film past an aperture in a lead lined case and a synchronizing mechanism to pulse the high voltage to the x-ray tube. Film up to five inches wide has been used successfully by Barclay ('45). The film exposure area is five inches square so that a heavy roll of film must be started and stopped rapidly in order to produce motion pictures. The practical maximum rate for this large size film has been three to four frames per second. Vibration becomes excessive above this speed. Since this process involves direct radiography, image size is limited to that of the film. An advantage claimed for this method is the utilization of the entire x-ray beam and use of intensifying screens to cut down exposure. Each frame is then duplicated a number of times thus resulting in a pseudo-motion picture.

The indirect method also has its drawbacks, but subject or image size is not one of them. The fluoroscopic image is photographed on either 35 or 16 mm film and then processed and printed for projection. This method is far more flexible than the direct method and is not subject to mechanical difficulties such as the rapid movement of large films and the pulsing of extremely high voltages. However, the limitations imposed by the optical system in recording the relatively weak fluorescent images has, in the past, required extremely powerful x-ray equipment and dangerously high x-ray dosages thus limiting the exposures to short periods of time. Since the light gathering qualities of the lens and

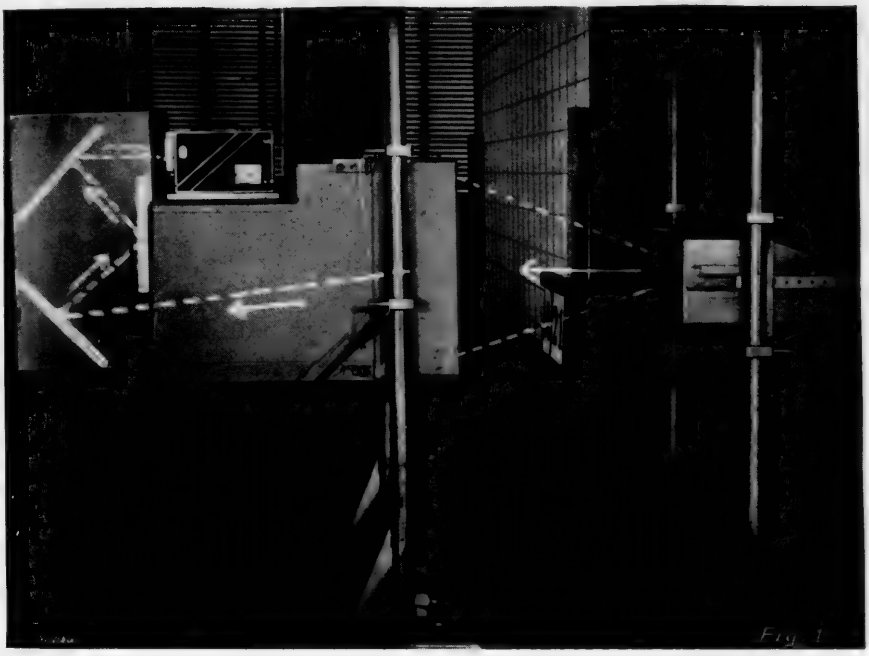

Figure 1.

sensitivity of the film is limited, the speed at which the fluoroscopic images may be photographed is thus directly proportional to the magnitude of the x-ray output and resultant screen brightness or intensity. Extremely fast lenses such as the Zeiss R. Biotar No. F.0.85 or 5.5 cm focal length have been used by a number of investigators, but we have been unable to obtain an extremely fast lens of this type.

The requirements of extreme light gathering by the optical system can be lessened somewhat by employing accurate synchronization. In the indirect method as employed by Reynolds, ('38), synchronization of the x-ray pulse with the movement of the film was performed by a switch that turned the tube on only when the shutter was open and the current turned off when the shutter was closed. A large commutator immersed in oil and driven by a motor pulsed the extremely high voltage (110 kilovolts) and current (60 millamperes) from the transformer to the x-ray tube, the other end of the motor shaft was used to drive the camera spindle. Thus it may be seen that the switching and pulsing effect of the commutator will tend to produce an aberration in the wave form of the x-ray, necessitate higher intensity exposures and make higher film speeds impractical. The equipment is rather large and requires consider-

able alteration in the x-ray installation and the handling of very high voltages.

Stewart ('37) also employed the indirect method but did not concern himself with the question of synchronization. His equipment consisted of a cine-camera with a Zeiss R. Biotar No. F.0.85 lens of 5.5 cm focal length and a powerful four valve, full wave rectified x-ray machine. The patient was exposed to dosages of 125 millamperes and 100 kilovolts for periods ranging up to a total of 15 seconds. This extremely high dosage, used on selected cases only, produced sufficient illumination of the fluorescent screen to be photographed at the rate of 16 frames per second. This speed was decreased to 12 or even eight frames per second in fat patients in order to increase the film exposure.

Synchronization provides the means of considerably reducing the exposures of the subject to radiation and increasing the film exposure density. However, synchronization of the pulse of the x-ray machine with the camera as employed by Reynolds and others involves handling high voltages through large equipment with the everpresent danger of arcing, whereas synchronization as employed by us is exactly opposite and involves synchronization of the camera only to the x-ray pulse. Our equipment consists of a half-wave rectified x-ray machine and the camera shutter is so synchronized to the x-ray pulse that the film remains stationary during the positive phase of the x-ray pulse when the x-ray radiation causes the screen to fluoresce and is moved during the negative phase when the x-ray is not on. Each pulse is thus utilized to expose a single frame of 16 or 35 mm film and a slow motion picture consisting of 60 exposures per second is obtained. We have also prepared motion pictures taken at 20 frames per second. Each frame receives two x-ray pulses or twice the exposure given the film at 60 frames per second.

This new method of synchronization eliminates the need of elaborate and cumbersome equipment and does not disturb the normal wave form or output of the x-ray equipment. The exposures required are a small fraction of those required by the other methods. The peak output of our equipment is only 20 milliamperes at 140 kilovolts. Since the x-ray equipment is half-wave rectified, the patient is subjected to one-half the exposures of a full wave machine such as that of Stewart. Half-wave rectified equipment will produce fluoroscopic images of greater intensity than will full wave machines since the peak output of the half-wave machine is considerably higher than the average voltage and current of the full wave machine at similar settings. Considerably longer total exposures could be given the subject in our studies of joint action, swallowing and the kinematics of the human gait with a resultant lower roentgen unit dosage than had been possible with the other methods.

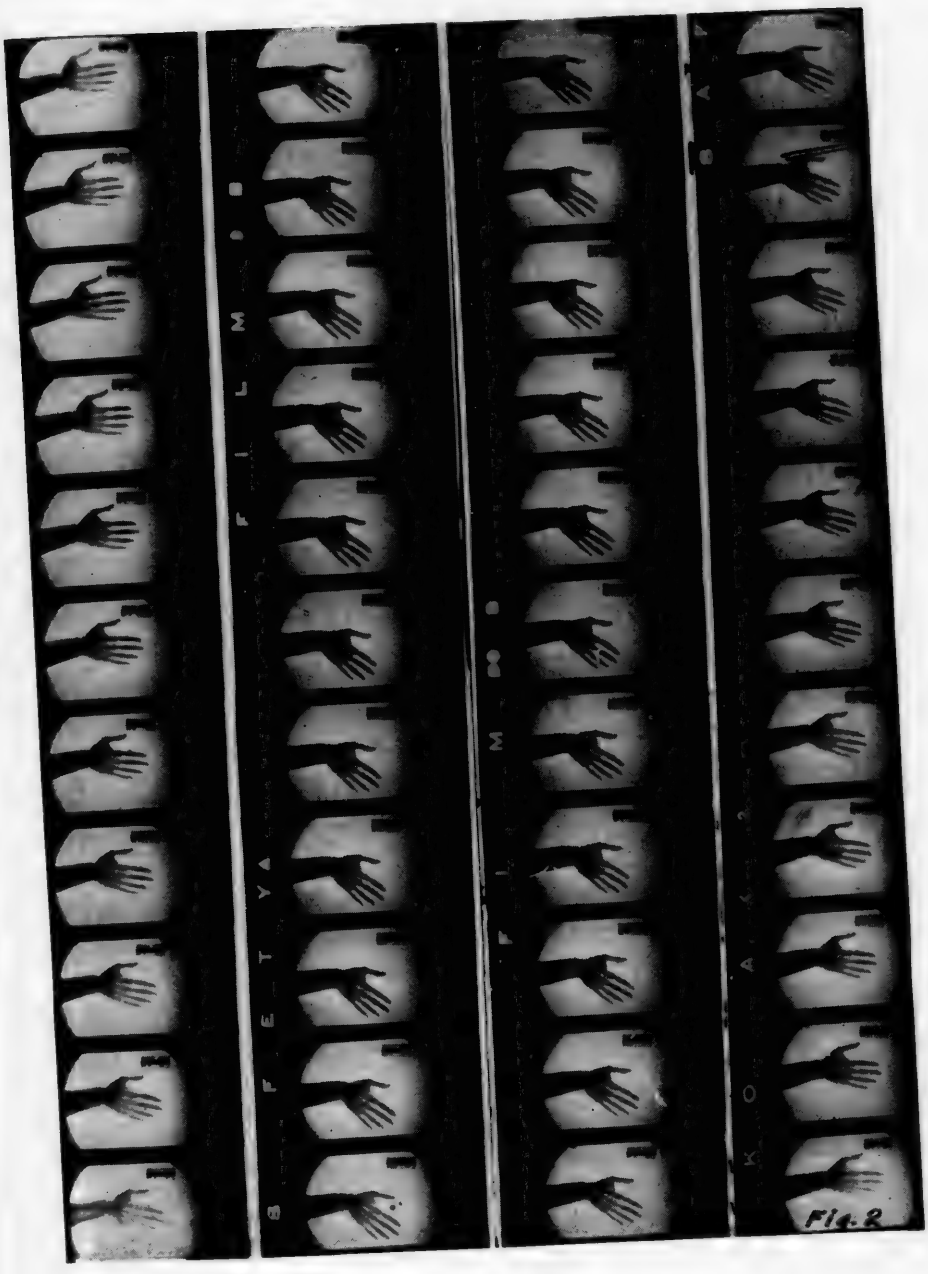

Figure 2.

The fluoroscopic screen used was a Patterson fluoroscopic type B whose spectral band ranges from 5200 to 6000 Angstrom units. This screen has relatively no afterglow or image persistence and is more desirable than those having persistence of the image. With image persistence serious difficulties such as ghost effect and over-all loss of contrast result in exposures at 20 or 60 frames per second. The grain size of the fluorescent screen influences the degree of light emission so that any increase in screen brightness would be obtained at the expense of sharpness of image. However, the resolving power of any film that might be used is greater than the image formed by the grain of the fluorescent screen so that film grain size need not be considered as a factor.

Comparative experiments and measurements are being carried on by us at present using a Patterson type D fluoroscopic screen to determine the relative speeds, and their effects in obtaining high speed x-ray motion pictures.

Several types of film have been investigated. Eastman Negative Recording has been found more satisfactory than Eastman Fluororapid film, due to its better contrast and finer grained image. Panchromatic film produced very poor results with the Patterson B screen due to a dip in the sensitivity of the film approximately at the point of greatest radiation of the screen. The blue fluorescing type D screen produces similar results since the maximum sensitivity of the panchromatic film is shifted away from the blue and toward the green. An orthochromatic film sensitive in the spectral range of 5200 to 6000 Angstrom units is satisfactory. These films may be obtained in 16 mm and 35 mm sizes; the 35 mm film may be reduced to 16 mm for projection purposes. Enlargements of the 35 mm images are preferable for measurements, to construct force diagrams and calculate the resultant forces. The advantages of enlarging 35 mm films rather than 16 mm films are readily apparent in this type of study.

Two cameras are being used in our "Gait Studies." A 35 mm Mitchell Camera having an f .95 coated Astro lens was so mounted that the fluorescent image could be picked up from the surface of a front-surfaced silvered mirror. A single front-surfaced mirror was used in some of the work, the image being reflected to one side into the lens of the camera which was shielded behind a lead screen. Subsequent work necessitated the mounting of the x-ray tube, camera, motor and synchronizing mechanism upon a movable carriage so that the subject would remain directly in the path of the x-ray beam. Three front-surfaced mirrors were used and the image produced on the film was not appreciably reduced in density, figure 1.

A Cinekodak Special was also used for the 16 mm work. This camera was equipped with an f. 1.4 lens that had been coated. A lead chamber having a lead perchlorate cell was used in our earlier work to shield the camera from the x-radiation. The front-surfaced mirrors transmitted a greater percentage of incident light than did the lead perchlorate cell so that eventually the cell was discarded in favor of the mirrors. Various other means such as the Schmidt ('32) system were considered but due to many inherent difficulties were abandoned.

The use of a half-wave rectified machine, this mirror system and synchronizing mechanism reduced the intensity and duration of the exposure of the subject to a minimum. Adequate shielding of the subject, camera and operator could be carried on without rearranging the x-ray equipment or room. Technic involving injection of contrast media, swallowing various types of meals, etc., were carried out and the results recorded at either 60 or 20 frames per second.

Special darkroom treatment of the film, such as hypersensitization before or after development, was not necessary. The exposed film, either 35 or 16 mm was developed in a contrasty x-ray developer for the full development time to produce a gamma as high as 1.8. Forcing development, when tried with this film and x-ray developer produced considerable chemical or developer fog. Prewetting of the film and the use of a short stop between development and fixation improved the quality of the image.

The synchronization, methods and equipment used in our high speed studies of functional anatomy may be briefly summarized as follows:

The indirect method of cinefluorography is employed. The camera shutter is synchronized to that of the x-ray pulse and not the x-ray machine to the camera as previously done by others. Motion pictures at speeds of 60 exposures per second, utilizing each x-ray pulse, and 20 frames per second, exposing each frame to two x-ray pulsations, have been prepared. Eastman Negative Recording and Fluororapid films have been used. Standard camera equipment having an f. 0.95 Astro and an f. 1.4 coated lens are shielded from the direct x-ray beam and record the fluorescent image reflected from front-surfaced mirrors. The half-wave rectified General Electric x-ray set and Patterson fluoroscopic type B and D screens are standard equipment. The major modification underlying the successful preparation of these high-speed films is the method of synchronization of the camera shutter to the x-ray pulse.

The many advantages of indirect cine-fluorography over direct radiography to the research worker, to the clinician and to the diagnostician need not be enumerated for they are readily apparent, figure 2.

A New Cinemicrographic Film Entitled: "Shape and Motility of Bacteria".

Adrianus Pijper, M.D., D.Sc., F.B.P.A.

This film seeks to prove the author's new and somewhat revolutionary theory about the shape and motility of bacteria. Orthodox bacteriology recognizes spheres (cocci), straight rods (bacteria or bacilli), and curved shapes (spirillums and vibrios). The film shows that at least these bacteria or bacilli which are regarded as motile, are not rod-shaped, but have the shape of a spiral.

The film is constructed like a scientific paper or essay. It builds up the argument step by step. It starts by illustrating the current views on the matter, and their historical origin. It then shows how on investigation with the author's sunlight microscope these views became untenable, and how further study led to novel conceptions. The techniques used are illustrated, and also the experiments and observations performed in order to confirm the new theory. Pictures of moving models of bacteria are used throughout the film to bring home various aspects. All the evidence produced points to the conclusion that motile bacteria are not rods, but spirals, propelling themselves by gyrating undulating movement of their bodies, and that their appendages commonly called flagella and commonly regarded as motor organs, are just mucous twirls which during and through the gyrating undulating movement of the bacterial bodies are twisted off from the mucous covering of the bacteria.

Duplicates of the film can be had from the author at cost price. A duplicate has been presented to Prof. Harry E. Morton, Chairman of the Committee on Materials for Visual Instruction in Microbiology, Society of American Bacteriologists, University of Pennsylvania, School of Medicine, Philadelphia 4, Pa.

Gastroscopic Color Photography*

James S. Watson, Jr., Harry L. Segal, Sydney A. Weinberg

SINCE the introduction of the Wolf-Schindler flexible gastroscope, it has been the hope of many gastroscopists that a relatively simple and effective technic would be developed to record in color the observations made by means of this instrument.

In 1936 Henning and Wolf[1] succeeded in taking a number of black and white pictures through this flexible gastroscope by means of an external camera. A year later Henning[1] was still unable to obtain color photographs through this scope because of insufficient light.

In 1940 Hull[2] described the adaptation of the Micro-Ibso attachment available for the Leica Camera to the flexible gastroscope made by Carl Zeiss. He suggested that the light source at the distal end of the instrument, operating from a small rheostat, could be turned to a high intensity at the time the exposure was made, or that a high-low synchronized switch could be connected. Black and white exposures from 1/20 to a full second were made on Agfa ultra speed film.

Although both of these authors reported successful photographs in black and white, they recognized the advantages of color photographs for recording and studying the changes seen in the stomach.

Taking pictures of any kind through the flexible gastroscope is difficult mainly because of the instrument's relatively poor light transmitting power. If a small camera with a lens working at f/3.5 could be conveniently introduced into the stomach along with the gastroscope, the standard gastroscope lamp would be ample for color photographs at about ¼ second exposure. In using the gastroscope as, not only a view finder, but also as a photographic objective, one is dealing with a much higher f/ value and consequently a decrease in the image brightness. Furthermore, the great number of glass elements needed to relay the image successfully through the flexible portion of the instrument cause additional light losses.

In order to overcome these handicaps, three steps were taken, each

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one of which multiplied progressively the amount of light finally reaching the photographic film.

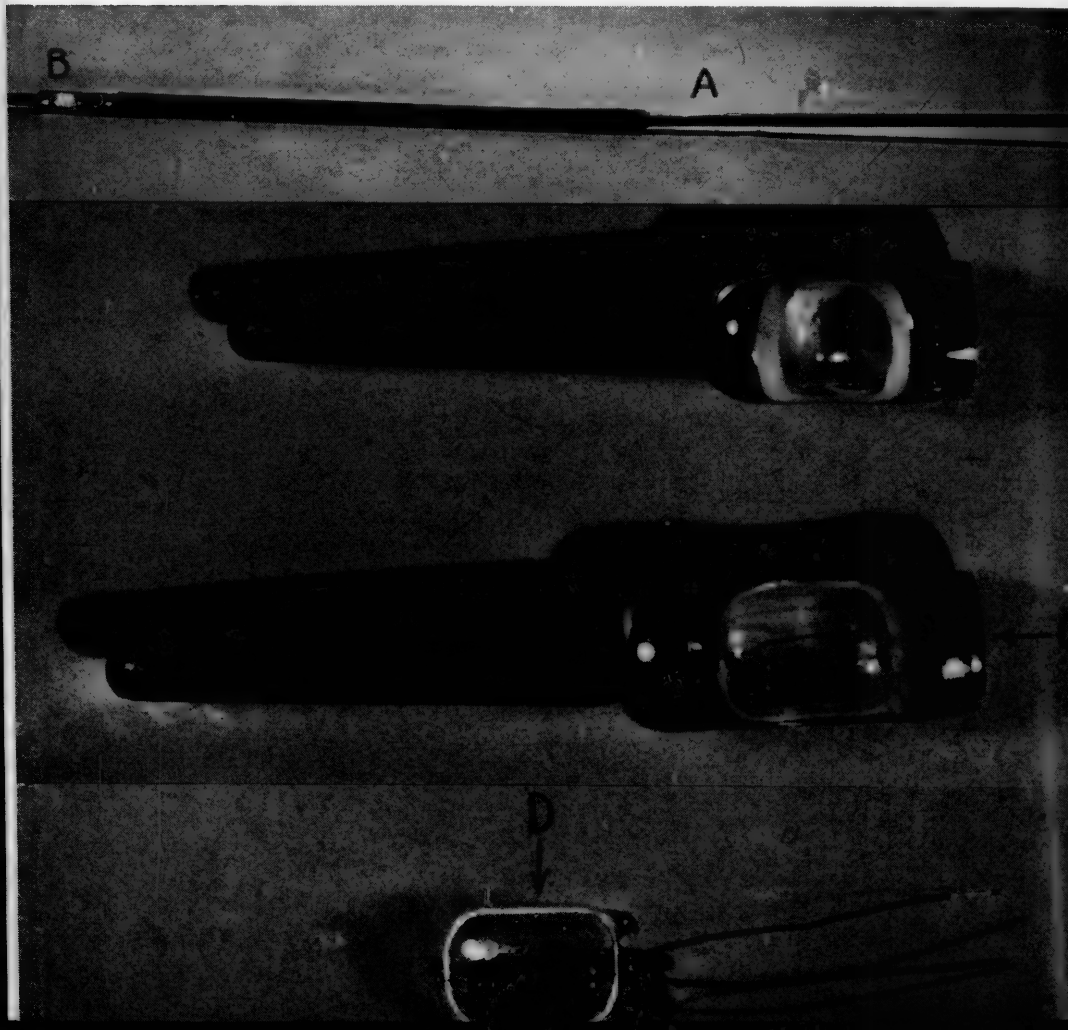
(1) All glass-air surfaces of the gastroscope were coated to cut down reflection losses.# This gave a light gain of about four times.

(2) A gastroscope lamp of increased wattage was developed, which could be safely "overvolted" during the taking of the picture with a resulting gain of three to five times.

(3) A short focus auxiliary lens was used behind the eyepiece to produce on the film an image of the smallest usable size. The gain in this case of course depended on comparison with a

The authors are indebted to the Carl Zeiss Company of New York, the Eastman Kodak Company and the Bausch & Lomb Optical Company of Rochester, New York in this connection.

Figure 1. Wolf-Schindler Flexible gastroscope showing comparative size of standard and improved lamp.
A. Gastroscope. B. Standard lamp. C. Improved lamp. D. Improved lamp, unmounted.



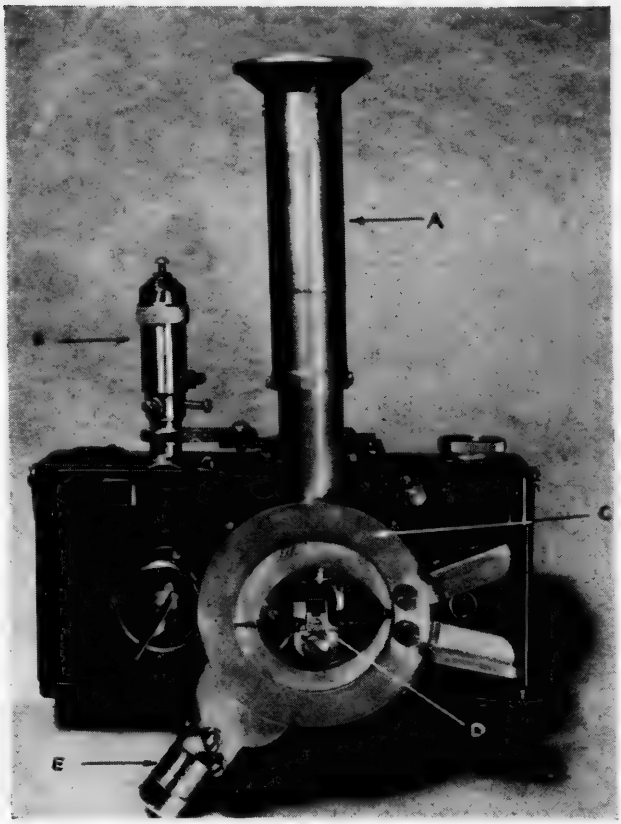


Figure 2. Camera and adapting mechanism.
A. Periscope viewing tube. B. Solenoid for camera shutter. C. Coupling device. D. Prism. E. Solenoid for prisms.

larger image previously tried, and varied inversely with the square of the image diameter.

The first coating of the Wolf-Shindler flexible gastroscope was done in 1942 at a time when so-called "soft" coating was still in general use[3]. In 1946 the glass elements were recoated, this time by the "hard" method perfected during the war[4]. Both coatings were at fault in one respect: they favored the transmission of yellow light, giving a slightly yellowish tinge to the image. This might be avoided by more careful coating or by a correcting filter. The latter is not desirable at present because of further loss of light.

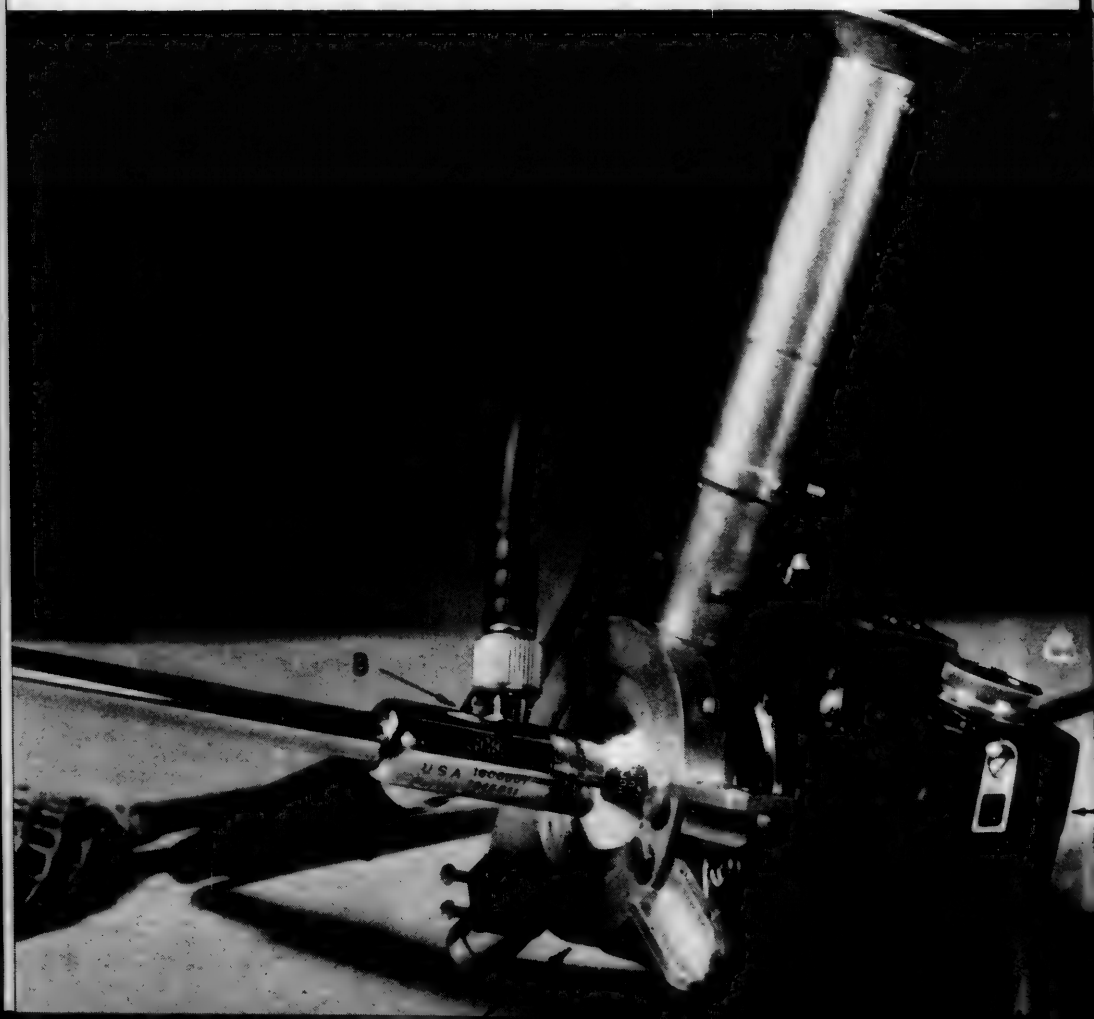
The next phase was the development of the lamp, the adapting mechanism for the camera used, and the power supply and synchronization unit.

The lamp (Figure 1) constructed has a specially made tungsten filament designed for normal operation at 25 volts, which can be stepped up to 80 volts during the exposure period. This improved lamp burns at about the same amperage as the standard gastroscope lamp. When overvolted its color temperature is suitable for type A Kodachrome. The diameter of the lamp housing is only a fraction of a mm. greater than that of the standard lamp, so that the gastroscope can be passed without difficulty. The heat generated is proportionately greater, but has not proved to be a disturbing factor.

The mechanism (Figure 2 and Figure 3) for adapting the camera to the gastroscope consists of a spring type coupling device, a periscope viewing tube, and a floating support having universal motion.

The camera used is the Zeiss Contax I. The standard lens of this

Figure 3. Coupling device of camera clamped over eye piece flange of flexible gastroscope.
A. Camera. B. Flexible gastroscope. C. Coupling device.



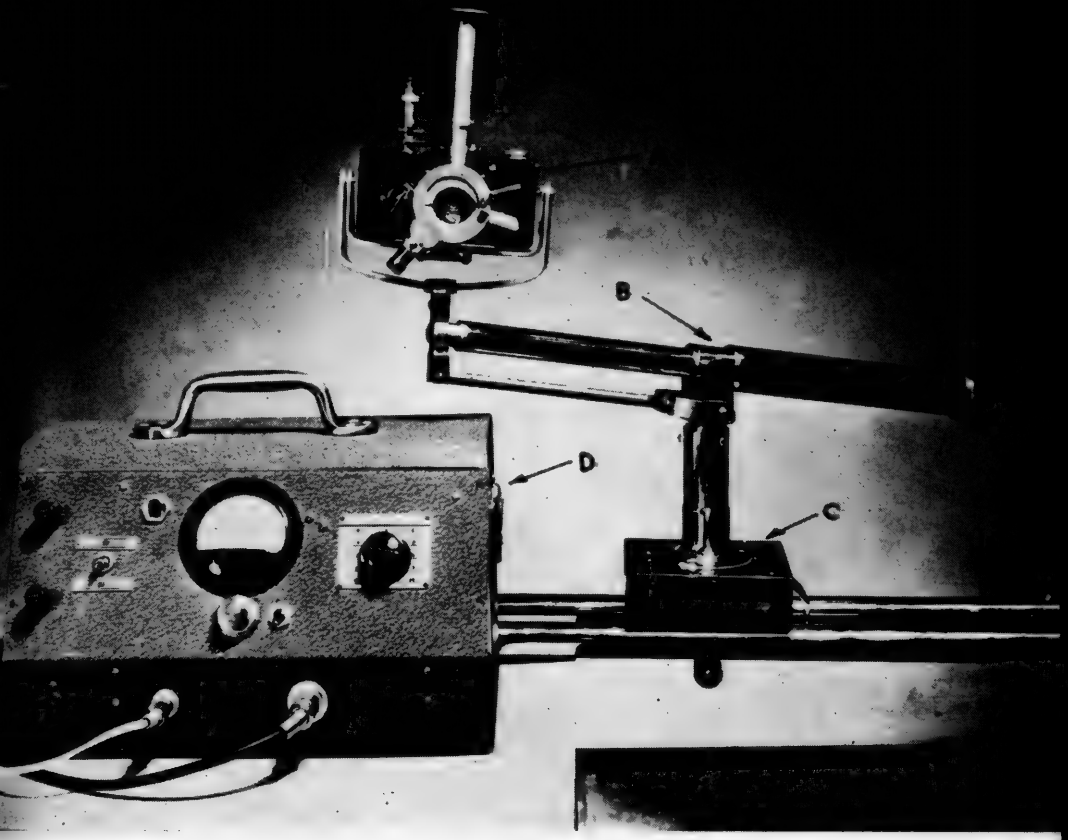


Figure 4. Complete system showing power unit for taking color photographs through the flexible gastroscope.
A. Camera with adapting mechanism. B. Support with universal motion. C. Trolley. D. Power control and synchronization unit.

camera has been replaced by an auxiliary lens of 28 mm focal length mounted between the eye piece of the gastroscope, and the film plane to bring the image to focus at about 46 mm from the eye piece. The resulting picture diameter is about 6 mm. The position of the auxiliary lens can be varied to compensate for any change in focus caused by the bending of the flexible portion of the gastroscope. However, the present apparatus is not completely satisfactory in this respect.

The power supply unit (Figure 4) is composed of an isolated transformer with a maximum output of 90 volts controlled by a potentiometer and volt meter. The lamp voltage, the periscope, prism and the camera shutter are operated in unison by a synchronous motor and cam-type discs.

A selenium cell rectifier with a 9 volt output supplies the current for the two solenoid type synchronizers. The film used is 35 mm Type A Kodachrome. The exposure time is ½ second. An even shorter exposure would be advantageous because of stomach movements due to peristalsis and arterial pulsations. This can be realized by a faster film. Experiments with such a film are now in progress.

The operation of the apparatus is as follows. The gastroscopic examination is begun in the usual manner. After locating the area to be photographed, the camera is swung into the proper position by an assistant, and the spring type coupling device is clamped over the eye piece flange. The view is checked through the periscope. The patient is instructed to stop breathing, and the exposure is made by pressing the button on the control unit. This simultaneously increases the voltage of the lamp from 25 to 80 volts, moves the prism of the periscope out of the light path, and then trips the camera shutter.

To insure against spoiling a diagnostically important record, several exposures of each view are made. The film transport and winding of the shutter mechanism is manual. The first gastroscopic color pictures using this method were taken in the phantom stomach. The next experimental exposures were made inside the human stomach.

After the development of a satisfactory technic, color photographs were taken in twelve selected patients who were gastroscoped for various reasons. A total of 151 exposures were made inside the stomach of this group with fair to good color reproductions of the endoscopic findings in 61.5%.

From the results obtained, it seems that a method is now available for providing objective documents of changes seen inside the stomach through the flexible gastroscope. Further advances will now be possible to simplify and perfect the present system.

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Phase Photomicrography*

Oscar W. Richards †

Many living cells, tissues and organisms are so transparent that they can scarcely be seen with the usual brightfield microscope. Increased contrast may sometimes be attained by closing the diaphragm of the microscope condenser to obtain a narrow cone of illumination. Other times the decrease in resolution from this procedure prevents seeing the detail before sufficient contrast is obtained. Such specimens do have detail as can be shown by staining and other methods. Phase microscopy makes visualization and photographs of this detail possible and avoids the loss of time and possible damage to the specimen from chemical treatment.

The Phase Microscope shows the organisms in sharp outline and with internal detail at full resolution. Phase microscopy utilizes optical path differences within the instrument to increase and decrease, or to reverse and increase or decrease contrast in the image. It is especially useful with unstained living cells, but when the contrast of stained material is not great, it is often possible to enhance visibility, especially of small details.

Optical path differences (optical path = thickness × refractive index) alter the speed of light passing through them. A greater path as C, figure 1, shows the wave B with respect to A which did not pass through the higher index region, but the eye and the photographic emulsion are insensitive to phase differences. Absorbing media like E, decrease the amplitude of the waves without changing their phase relations and such differences are visible and photographable. The change of phase into amplitude differences is accomplished by the phase microscope.

An annular diaphragm L is placed at the front focal plane of the condenser. Light from any point L, likewise from every point in the annulus, passes through the condenser and comes to a focus somewhere in the objective system. In the 16 mm. Spencer objective this occurs between the lens systems at J' and a bright ring of light is formed there as a small image of the opening in the diaphragm K. At this point is placed a diffraction plate J, which is a piece of optical grade glass with a thin layer of metal or of a dielectric, or both, large enough to cover the conjugate or image area. Or, the phase altering materials may be

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placed over the rest of the disc, on the complementary area.

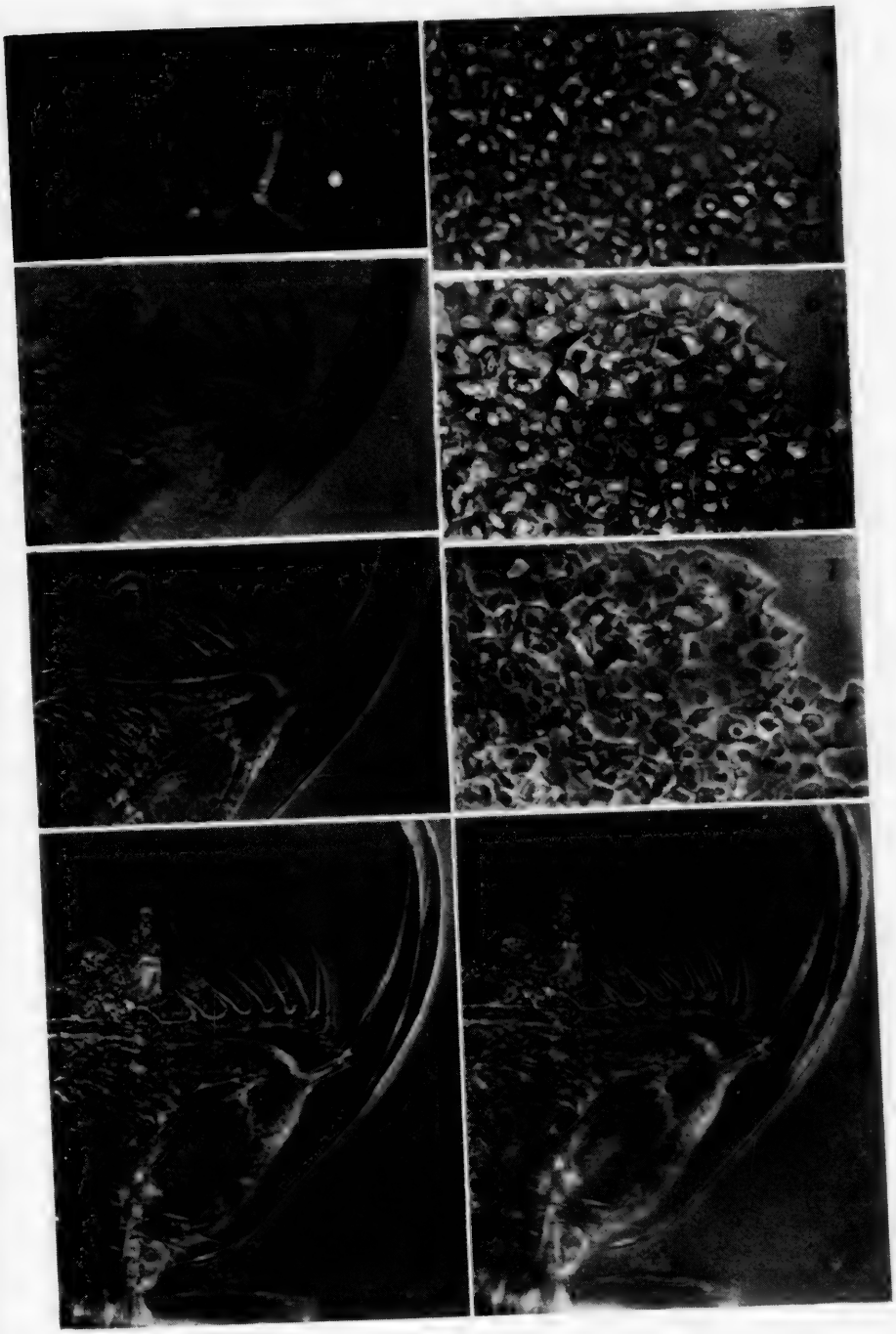
When a specimen is placed in focus at N, a part of the light is deviated by it and most of the deviated light from the specimen does not pass through the conjugate area. The diffraction plate can affect differentially both the deviated and undeviated light from the specimen and the undeviated light from the background depending on its composition. Four types of diffraction plates are possible, figure 1, F, G, H, and I, although the B^+ type, H, has found little use in biology. An A^+ plate like F retards and partially absorbs the undeviated light without affecting the light deviated by the specimen and gives bright contrast (i.e. regions of greater optical path will appear brighter than regions of the same size of lesser path). The A— diffraction plate, G, partially absorbs the undeviated light and retards the deviated light, giving dark contrast. The B— type, I, does not affect the undeviated light from the background but partially absorbs and retards the deviated light from the specimen and also gives dark contrast.

The absorbing metal layer may be made of any desired transmission and the retarding layer depends on its optical thickness for its action. The most frequently used plates are a $0.2A^+0.25\lambda$ for bright and $0.2A—0.25\lambda$ for dark contrast. These absorb about 80 percent of the undeviated with respect to the deviated light and retard (+) or advance (—) the phase relations of the undeviated light with respect to those of the deviated light. When all of the light comes together to form the image, rays like R, figure 1, add together to give a brighter image while those of the same amplitude but of opposite phase destroy each other, giving no light and appear black. Other combinations provide greys. Thus the invisible phase changes from transparent specimens are changed to visible amplitude differences. Further explanation requires mathematical analysis and is available elsewhere with a history of the method.[1] Many applications of the method have been described with bibliographic references.[2]

Bright contrast, Plate I, figures 1, 4, 6, is useful for smaller details, for counting and has been generally preferred by the protozoologists.

Plate I:

1. **Living, unstained ciliated epitheleal cell from the mouse lung. Phase Microscope, Bright Contrast. 450X.**
2. **Part of head end of Daphnia longispina. Brightfield Microscope. 600X.**
3. **Same as 2 with Phase Microscope. Dark Contrast. 600X.**
4. **Stereoscopic photomicrographs of Daphnia longispina. Phase Microscope. Bright Contrast. 600X.**
5. **Epithelium from nictitating membrane of frog, living, unstained. Brightfield Microscope. 110X.**
6. **Same as 5 with Phase Microscope. Bright Contrast. 110X.**
7. **Same as 5 with Phase Microscope. Dark Contrast. 110X.**



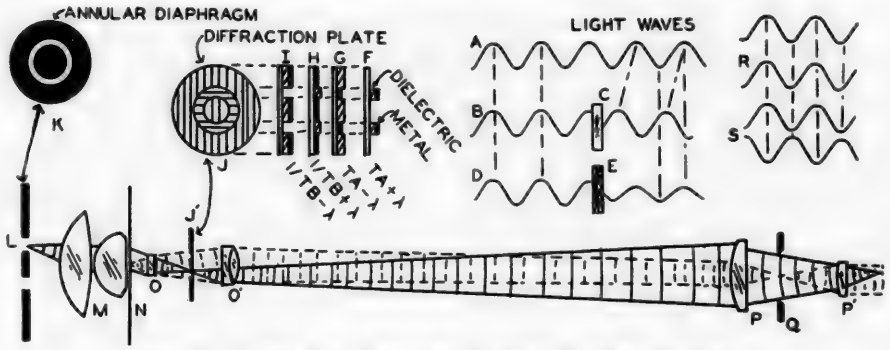


Figure 1. Light path through the Spencer Phase Microscope.

Dark contrast, Plate I, figures 3 and 7, is useful for measuring and gives an image more like that obtained with stains. Some specimens reveal more detail with one than the other, others are seen equally well with either contrast. Some observers prefer one to the other. Photomicrographs are made equally well with both. The image of the edge of a small detail on a film or plate is denser with dark contrast, probably due to the Eberhard effect during development, which facilitates measurement, although both contrasts give the same dimensions.[3]

While a large number of combinations of absorption and retardation are possible for each type of diffraction plate, experience has shown that a small number are adequate for practical microscopy. The most generally useful plates are a 0.2A+0.25λ for bright and a 0.2A—O.25λ for dark contrast. These show larger cells, micro-organisms and considerable detail within them. For smaller organisms the 0.14A+ and A—0.25λ are better, *e.g.* bacteria and smaller organisms and crystals and for detail within bacteria the greater bright contrast of the 0.07A+ 0.25λ is desirable.

The 1B—0.25λ dark contrast is useful with supravitally stained preparations and the 2.5B—0.25λ reveals details in Sudan Black stained material, in living yeasts, bacteria and for unstained plant chromosomes.

When stained preparations have low contrast it is often possible to increase the visibility with A(—) or B(—) diffraction plates. Color contrast can be added to the phase contrast with suitable color filters. Carmine stained chromosomes and carbol fuchsin stained material show much better with bright contrast A(+) diffraction plate and a red Wratten "A" filter. In this application similarly colored filters give better detail than the commonly used complementary colored filters.

Some specimens are revealed better with other diffraction plates.

A 0.2A+0.33λ plate is usually better in the 16 mm objective than a 0.2A+0.25λ. The 0.35A+0.25λ diffraction plate is good for nucleat detail. Small tumor cells and one of the larger phages showed best with a 0.2A+0.1λ plate. Cysts of intestinal parasites were revealed with 2.5 to 3B—0.4λ diffraction plates. Glass, crystals and some plastics show better with retardations greater than ¼ wave length. Diffraction plates may be obtained for 16, 8, 4, and 1.8 mm objectives.

The Spencer equipment consists of a condenser with separate centering screws for the condenser and for the annular diaphragm, an objective with appropriate diffraction plate and a telescope for centering. In use, the microscope is focused on the specimen, the telescope placed in the eyepiece tube of the ocular and the condenser is centered to the diffraction plate. The annular diaphragm is inserted into the condenser and centered to the plate, the telescope is removed, the ocular replaced and the instrument is ready for use. A good research type microscope lamp with a focusable condenser is desirable for best results. For greatest contrast monochromatic light is desirable. It is not difficult to use the equipment and full directions are supplied.

No special preparation methods are required, although thinner are better than thicker preparations. Wet mounts should be sealed with petrolatum jelly. This is readily done by rubbing a small amount along each edge of the cover glass and inverting over a small drop on the slide. Preparations of living cells may remain suitable for study up to several days.

Photomicrographs are made with the phase as with other kinds of microscopes. The microscope is centered to the camera, the light directed to the center of the mirror (for vertical setup) or to the center of the microscope condenser and the lamp condenser focussed to image the lamp filament on the microscope condenser iris. The phase equipment is centered as previously described, the lamp iris is focused in the specimen plane with the microscope condenser, the microscope is focussed to the plane of the film and the picture made.

With uncolored specimens the ortho or process emulsions are suitable, in the contrast preferred by the photographer. For a generally useful emulsion a type B panchromatic emulsion of fine grain may be used. When 35-mm film is used in a still camera and considerable enlargement planned of the negative a fine grain developer should be used. When color is involved a panchromatic emulsion will be required. Pictures in full color may be made with Anscocolor or Kodachrome.[4]

Exposure may be estimated from the appearance of the ground glass, from measurement or obtained by trial. The 1B(—) type diffraction plates may not increase the exposure and those of greater absorption usually require no more than twice the exposure of the same preparation at full aperture. The 0.2A+ and —0.25λ plates absorb more light and the exposure is usually about the same as would be required for the same objective when the condenser of the brightfield microscope is closed enough to give optimum contrast, to twice as long an exposure. Diffraction plates of lower transmission as the 0.14 and 0.07 A+ and A— types will often require twice to four times greater exposure. When color filters are used the exposures must be increased by the factor for the filter. The photomicrographer can thus estimate a trial exposure from his previous experience. In this laboratory, exposures run from 1/50th to 2 seconds, mostly about 1/10th second, with a 100 wt, T-8, CC-13 lamp in a Spencer No. 370 microscope illuminator on Panatomic-X cut film.

When the light intensity from the microscope is high, it is easy to measure it, or to estimate the exposure from the appearance of the ground glass. The regular photoelectric exposure meters may be used by assuming an arbitrary value on the f-scale, and this procedure has been described by Maurer.[5] The Hickock Exposure Meter has been found convenient, as the extension protecting the sensitive element can be placed on the ocular, giving a fixed reference position.

When the intensity of the light is low, it is more difficult to judge the exposure by eye and the ordinary exposure meters are not sufficiently sensitive for correct measurement. Photoelectric methods are possible, but require an amplifier or a sensitive galvanometer, or both, making the equipment expensive and less portable.

An alternative is to use a visual photometer which contains a standard reference lamp. While the eye is not adapted to judging absolute values it is capable of making good comparative measurements. Loveland has discussed the advantages of this kind of exposure meter and proposed a design.[6] Another design is given in the appendix to this article and such a meter has been found useful here for phase photomicrography.

An increased plastic or third dimensional effect is noticed in pictures made with the phase microscope, especially with bright contrast. This suggests the advantages to be derived from stereophotomicrographs. The stereo-pair, figure 4, may be observed with a stereoscope, although many people can fuse them into a single three dimensional image without instrumental aid. Hold the plate at the usual reading distance and

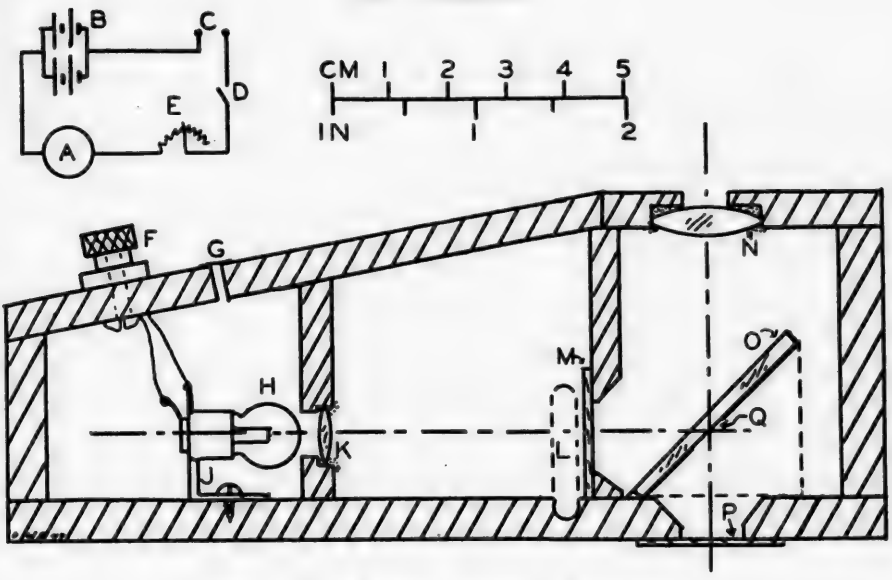


Figure 2. Cross section diagram of photometer.

raise it so that you may look under it at a distant object. Lowering it quickly then will often help in securing fusion. Another method is to look through the pictures as if they were at a distance. With practice one can usually fuse the pictures without the aid of a stereoscope.

Several methods are possible for taking the two negatives for the stereo pair.[7] Perhaps the best is to tilt the specimen about 7° to the right for one picture and then 7° to the left for the other, but this is not practical for use with objectives of greater focal length than 16mm. For greater magnifications the half aperture method is useful.

A piece of black cellulose tape was placed over the annular diaphragm of the phase equipment to stop all the light from one lateral half of the opening. A picture was made, the annulus rotated 180° and the second picture made. This half aperature method was used for figure 4. It does have a limitation in reducing the resolving power of the objective one-half, but as few photomicrographs are made of specimens close to the limit of resolution, this is usually not a practical limitation. The two prints are mounted so that corresponding points are about 2½ inches apart.[8]

The small details revealed in small organisms and in colloidal solutions with phase microscopy are difficult to see and measure because of the actual locomotion of the organisms and the ever-present Brownian movement of the small particles. A rapid exposure with an intense light is required for phase photomicrographs of such specimens. A

flash tube of the Edgerton type in an experimental housing was used on Nov. 28, 1945, by C. S. Foster, Wennemark (Eastman Kodak Co.) and the writer for successful phase photomicrographs of an emulsion (milk) bacteria and a rotifer using both bright and dark contrast at about 1/20,000 second exposures.

Through the kindness of Mr. Frank Carlson (General Electric Company, Nela Park) I obtained an experimental gap type of flash tube which proved very convenient for photomicrography. This tube consists of a glass envelope about 1¼ inches in diameter and 3½ inches long with electrodes extending in from each end to within about 4mm of each other. The lens system of a Spencer No. 370 lamp was used to focus the tips of the electrodes to the opposite sides of the opening in the microscope condenser. The discharge thus illuminated the full aperture and was sufficiently uniform for photography. To obtain light for finding and focussing the specimen, the filament of a Spencer No. 363 lamp was focussed to form an aerial image between the two electrodes of the flash tube and was turned off previous to the flash exposure. Exposures were estimated to be approximately 1/35,000 second and obtained by discharging a condenser of 60 to 105 microfarads capacity charged to 1.8 to 2.5 kv. through the tube. Good photomicrographs of emulsions and small organisms have been obtained using a fast emulsion such as Superpanchropress, type B. The flash technic stops locomotion, Brownian motion and vibration motions of the specimen making possible sharp photomicrographs. The flash tube is available as No. FT-230 and requires a power supply for operation. The intensity is not yet adequate for photomicrographs in color with the phase microscope.

Summary

Phase microscopy is a method for controlling the contrast in the image and is useful for the examination of transparent materials with small optical path differences or low absorption contrast, such as living organisms and stained specimens of low contrast. The structure and use of the phase microscope is discussed briefly with respect to photomicrography. Stereophotomicrographs show good detail and are useful in many research studies. A fast flash tube lighting is described to stop locomotion and Brownian motions of the specimen and a simple, visual, step photometer is described for estimating the required exposure.

Appendix

The photometer, figure 2, consists of a box made of quarter-inch wood, which encloses a lamp for illuminating the ground glass M, a

mirror, O, with a hole in it, Q, a ground glass illuminated by the light to be measured and a slit, L, through which a step tablet may be moved to vary the light on M. In use one looks through the opening and lens N and sees the ground glass P through the hole in the mirror surrounded by the reflection of the ground glass M. The step tablet is moved through the slot until the intensity of the ground glass M appears to be the same as that of the ground glass P. The number of the step which accomplishes the match is the value used for determining the photomicrographic exposure. It is used at the plane of the film after the ground glass is removed.

A box houses the photometer when not in use and holds the electrical equipment. Four size D flashlight batteries are used, B figure 2, connected in series multiple for long life. Two could have been used, but the lamp draws enough current to require considerable adjustment when used often. A one ampere meter A, is used and the lamp run at 0.6 ampere by means of the 3 ohm adjustable rheostat, E. D is an on-and-off switch and C are binding posts for the cord to the photometer. The lamp used is a G.E. Mazda No. 412, 1.8 volt, 0.73 ampere, G4.5. The lamps should be "seasoned" by burning for a day at a little less than the full voltage. Following this the light output will be quite constant at a given amperage for a long period of time, especially when burned at less than full wattage. The value of 0.6 amp. was chosen for this reason. An ammeter is preferable to a voltmeter with low voltage, direct current.

Binding posts are mounted at F on the top of the photometer housing for the wire from the battery box. An opening, G, is a convenient pilot to remind one when the light is seen burning when it should have been turned off. It should be made dust-tight by cementing a piece of clear film over the opening. The lamp, H, is held in a radio pilot light socket, J. A small double convex lens of 10 mm focal length spreads the light uniformly over the opening at M. The lens, N, with a focal length of 50 mm and gives a magnified view of the central part of the mirror which assists in making the comparisons. The mirror, O, should not be too thick, is cut to size, and mounted at 45° to the horizontal. A 5 mm diameter opening through which P is viewed was carefully scratched through the silver. The edges of the remaining silver should be sharp to insure a good margin for comparison. The ground glasses, M and P, were made by grinding one side each of two haemacytometer cover glasses.

If lenses of reasonably similar focal lengths are used, the distances and size of the photometer should be changed proportionately. The

proper positions are easily found by trial. Lens K should give an even spread of light on M, and N should be far enough away from Q to give a clear view of Q.

A step tablet (Eastman Kodak) was used to modify the light from the lamp in controlled steps. It was cut into strips of proper width to cover the light to the opening back of M and mounted between two pieces of glass with a half-width strip of lantern slide binding paper. The step tablet consists of a series of increasingly dense areas. For photographic use this has been found adequate and makes a less expensive and more compact instrument than seems possible with means for continuously variable intensity. If a foot candle meter is available the instrument can be calibrated against it and exposures figured by the foot candle-second method described by Loveland.[6]

However, a calibration in known absolute units is not necessary. If readings and trial exposures made over the range to be used one can soon find what level of illumination requires a given exposure for a particular emulsion. By taking a reading over the brightest and darkest parts of the image to be photographed the range is known. For reversible materials the readings should be made on the brightest regions and for negative materials it is usually preferable to measure and expose for the important darker parts of the image.

The range of the exposure meter can be extended by placing a piece of film fogged until 50 percent of the light passes through in front of the opening at P. This will double the range and the readings will have to be multiplied by two.

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First International Competition

Photography in Science
December 26-31, 1947

Sponsored by the

Smithsonian Institution and the Scientific Monthly

BPA members are urged to submit entries for the forthcoming international salon of Photography In Science. The aim of the competition is to develop and extend the use of photography as a basic research tool. Professional scientists engaged in teaching, research, consulting or private practice are eligible to enter the exhibition.

The committee will allow a wide range in both the choice of subjects and the types of equipment to be used. Entries using the electron microscope, the photomicrograph, macrophotograph, the X-ray and other media are all qualified. Each entry should be accompanied by concise and explicit information about the methods and techniques used. No entry fees are required, but entrants are asked to supply containers and to defray the cost of shipment to and from the exhibit.

The judges of the competition will be two distinguished authorities on photography, cooperating with two scientists under the direction of the Associate Curator of Graphic Arts of the Smithsonian Institution, Washington, D. C. The committee will consider the initiative, originality and results obtained through photography more than composition and pleasing pictorialism. Proper developing and finishing will be given consideration in the judging.

There will be first, second and third awards in each division (black and white and color) plus five honorable mentions. Additional awards may be authorized by the committee to cover unusual entries. The winning prints will be published in the January, 1948, issue of The Scientific Monthly.

Dates

The competition is planned as an annual salon. Entries will be received in Washington from September 25 to October 15. The accepted entries will be hung in the Smithsonian Institution from November 1 to 30, they will then be shipped to Chicago for display at the International Science Exhibition of the American Association for the Advancement of Science from December 26 to 31.

For complete information and rules write to Frank Campbell, Editor, The Scientific Monthly, 1515 Massachusetts Ave., N.W., Washington 5, D. C.

Book Review

Graphic Graflex Photography by Willard D. Morgan and Henry M. Lester, Publishers Morgan and Lester, New York. Eighth Edition, Revised. 456 pages, 29 chapters, 7½x10 inch page size, 650 illustrations.

This elaborate book covers all the important procedures in the use of the Graflex. The text includes a mass of valuable information ranging from the elementary to the most advanced. A great deal of thought has been spent on the photographic problems of today, and many hints are presented which cannot help but stimulate the photographer. This book should be read by all, and studied, for something new, something fascinating will surely be found. By its use, the photographer is bound to improve his photographic work. Morgan and Lester have again made a definite contribution to the field of photography.

Leica Manual by Willard D. Morgan and Henry M. Lester, Publishers Morgan and Lester, New York. 551 pages, 435 illustrations, 5¼x8 inch page size.

The improved eleventh edition of this book has been brought up to date. The 22 chapters are packed with authoritative and useful information, and are divided into three parts: Part 1, "Basic Leica Camera Technique", Part 2, Leica Camera in Science and Education", Part 3, "The Leica Camera in Specialized Fields". Descriptions of the new Leica VIII synchronized flash unit is included, together with color photography and color printing. The index completes the volume. In the practice of the art of miniature photography, the Leica enthusiast will find this book to be a "must" in his library.

THE EDITOR

The new P.S.A. Journal made its bow with the January, 1947, issue. It is changed in size from a 6½x9 inch format to one of 8½x11 inches.

This new size is much more effective in presenting the fine cover illustrations now being featured. It allows the use of more and larger illustrations in the text,—which is of prime importance in a photographic magazine of this type.

The subject matter covers a much wider field, and presents news and other information about the P.S.A. for its members, plus the newest and most pertinent in photographic literature relative to technical and industrial progress, camera club operation, pictorial, salon, color, nature and motion picture photography.

The editor, Fred Quellmalz, Jr., and his editorial staff are to be commendtd on the excellent publication that they are furnishing to the P.S.A. membership.

In any wide-spread organization, lacking close personal contacts, the official publication is the strongest existing factor in knitting and holding the membership together, and while doing this it makes a larger and more important organization possible. At the same time the journal grows greater itself, becoming a powerful activating force to the organization fostering its publication.

The new Journal is a real credit to the Photographic Society of America.

Ray Miess

Association News

Miss Patricia N. O'Neill, A.B.B.S., has received the first Master's Degree in Medical Art (M.M.A.) ever conferred. She completed graduate courses at Southwestern Medical College in May, 1947. In honor of the occasion, and to celebrate the pioneer achievement of the Medical Art Department, a dinner was given at the Melrose Hotel, May 26. The invitations were issued by Mr. Lewis Waters, Professor of Art as Applied to Medicine, who has worked, with untiring vesion and persistence, for the institution of B.A. and M.A. degrees in medical art.

Lorus J. Milne's pictures are well known to readers of "Nature" and to visitors at our Salons. Since 1942 he has been working in the field of aviation medicine at the Johnson Research Foundation, University of Pennsylvania. Recently he was appointed associate professor of zoology at the University of Vermont, to be effective in August.

If you should ever have to weigh a gorilla and don't know how to go about it, consult Sam Dunton's Pictures in "Animal Kingdom," the Magazine of the New York Zoological Society, Vol. 44, No. 6, Nov.-Dec. 1946. Part of the time a gorilla wants to play; part of the time it wants to fight; all of the time it's curious about what is going on. The camera has to be kept out of its reach—that's the first requisite; so do the lights, yet there has to be enough light to penetrate into any corner the gorilla may retire to. And if plenty of well-distributed light doesn't fall on the shaggy fur, you may get a picture that is only two white eye-balls. Moreover, besides the gorilla, there is the keeper to look out for. It is his job to get the gorilla weighed, and in the ensuing boxing-matches, hugs, and catch-as-catch-cans, he can't take time to look into the camera—nor even to know where the camera is. So the photographer is strictly on his own, and he's moving around a good deal more than he's standing still. The wonder is that any shots result, but at the Bronx they did and they made a good story, such a good story that the New York Journal-American for April 26, 1946, devoted a good part of a page to it.

Photography at the A.M.A. Scientific Exhibit, 1947

There was a startling increase in the number and quality of photographs used in the 1947 Exhibit as compared to, for instance, the AMA Exhibit in Atlantic City in 1942. Of the 300 scientific exhibits, fully

three quarters used photographic illustrations; many consisted wholly of pictures.

A like growth was evident in the use of motion pictures. The efficient handling of this part of the program by Ralph Creer, Secretary of the AMA Motion Picture Committee, deserves recognition. Besides the many films that were used during the presentation of papers, four motion-picture theatres in the Exhibit Hall were in constant operation. One film, produced by the AMA under Ralph Creer's supervision, was of great interest to visually-minded doctors no matter what their fields, and to anyone with an interest in photography. It showed the history of the medical motion picture from the first flickering, contrasty films in the early part of the century to the present highly specialized techniques in sound and full color.

In the booths of the scientific exhibit much of the work was in color, as might be expected. The quality of the pictures was good; particularly of the transparencies. There was a conspicuous lack of 2 x 2 inch transparencies in the exhibits; the tendency being toward 8 x 10's. Some 3¼ x 4¼ slides, however, were used with good effect, notably in the exhibit "Photography in the General Hospital" assembled by Dr. Milton Bohrod and John Beiter of the Rochester General Hospital. Here approximately 500 color transparencies, most of them standard lantern slides, were grouped to illustrate the various services photography can perform in a hospital. The use of brightly colored backgrounds, well known to those who have seen pictures from the Rochester General at our meetings, made this a dramatic and vivid exhibit.

The Association of Medical Illustrators had an exhibit in the booth next to ours, showing early and modern medical art in an interesting series of illustrations. The most striking feature of their exhibit was a group of models made of newly-developed plastics.

The BPA Exhibit was titled "Pictures for Publication and Projection." Stanley McComb did the over-all planning, wrote the captions and summaries and assembled the finished material. At the time the exhibit for the AMA was first broached, the Los Angeles Chapter had promptly volunteered to help. A description was sent them of the sort of illustrations needed (illustrating good and bad points in pictures for publication) and many of the illustrations were furnished by them. The Section of Photography of the Mayo Clinic cooperated in the lettering and mounting. And the finished product was hung and attended by Albert Levin and Anne Shiras, with assistance from Julian Carlile.

The material was mounted on nine 30 x 40 inch panels. Two panels on the left wall outlined the specifications for tabular and textual slides with illustrations showing the decrease of legibility with increase of audience viewing-distance. On the right wall two panels gave a summary of the important points to consider in planning medical photographs; and of the faults encountered most often in pictures for publication. This information had been summarized from a questionnaire circulated among Journal editors and the publishers of medical books and journals. On the back walls five panels stressed the salient points of photographic technic. Good and poor focus, definition, background, elimination of distracting elements; general lighting, texture-lighting, exposure and paper contrast were shown by means of comparative pictures.

A number of color transparencies and prints were contributed by H. L. Gibson, Dr. Ernest Rosenthal, Frank Ruslander and William Stevenson. These were used to demonstrate the quality which must be achieved in color pictures for successful reproduction.

At a rough estimate, 1,000 doctors examined the pictures and read the captions. 354 signed up as being interested in the BPA or in receiving data on a particular subject. The specialty most frequently mentioned was skin-work. Another fertile field for questions was ophthalmology; another, endoscopic photography; and of course, the perennial favorite, photomicrography. The reaction to our exhibit was one of interest, throughout; with particular concentration on the lantern slide section. Practically all our visitors spoke with feeling about the illegible slides shown at meetings—at the AMA as well as elsewhere. One doctor said he had grown so tired of straining to read tables too small to be seen he had solved the difficulty by taking opera glasses whenever he went to meetings.

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(Continued from Inside Front Cover)

production of photographic and processing materials will be shown. Transportation will be provided for both of these trips.

An all-day symposium on medical photography will be held at the Rochester General Hospital. Dr. M. G. Bohrod has arranged an interesting paper and demonstration session for the members and guests of the Association. The Cocktail hour and Banquet will occur on Saturday evening, September 13. The principal speaker at the Banquet will be Dr. K. C. D. Hickman as previously announced in the June number of the Journal. Dr. Arthur Proetz will be the Toastmaster.

Papers Scheduled for Presentation 1947 B. P. A. Convention

"Physical Principles and Techniques of Auto-Radiography"
George A. Boyd, University of Rochester, School of Medicine and Dentistry.

"Biological Applications of Auto-Radiography"
Dr. William Neumann, Assistant Professor of Pharmacology, University of Rochester, School of Medicine and Dentistry.

"Color Photography with the Gastroscope"
H. L. Segal, M.D., University of Rochester, School of Medicine and Dentistry.

"Color Photography in Plastic Surgery"
J. C. Detro, M.D. and John J. Beiter, Rochester General Hospital.

"Photomicrography in the Ultra-Violet"
George I. Lavin, Ph.D., Rockefeller Institute for Medical Research.

"Application of the Western Union Zirconium Lamp in Biological and Medical Photography"
W. J. Robinson, Research Laboratories, Western Union Telegraph Company.

"The Use of the Western Union Lamp in Photomicrography for Black and White and Color"
Julius Weber, Department of Photography, Columbia University, College of Physicians and Surgeons.

"Practical Applications of Lighting in Clinical Photography"
Ferdinand Harding, Children's Hospital, Boston, Mass.

"A Visual Photometer for Exposure Determination in Photomicrography"
Oscar W. Richards, Ph.D., American Optical Company, Buffalo, New York.

"Modern Trends in Microscopy"
K. J. Heinicke, Ph.D., Scientific Bureau, Bausch & Lomb Optical Company.

"Evaluation of Anti-Reflection Films in Photomicrography"
James R. Benford and Douglas A. Bly, Scientific Bureau, Bausch & Lomb Optical Company.

"The Preparation and Use of Endoscopic Color Pictures in Medical Teaching"
Paul H. Holinger, M.D. and J. D. Brubaker, Evanston, Ill.

"Making Lantern Slides"
Charles S. Foster, Eastman Kodak Company.

"Infra-Red Photographic Study of the Superficial Veins of the Thorax in Relation to Breast Tumors"
Leo C. Massopust, Marquette University, School of Medicine.

"A Method in the Preparation of Medical Motion Pictures"
M/Sgt. Stephen P. Dittmann, Army Institute of Pathology, Washington, D. C.

"On the American Cancer Society's Project for Assembling a Library of Best Available Color Slides of Clinical Cancer"
Charles S. Cameron, M.D., American Cancer Society, Inc.

"The Synchronized Shutter in Flash Photography"
Alfred L. Lidfeldt, Wollensak Optical Company.

"A Motion Picture on Cancer Cytology"
J. Ernest Ayre, M.D., Director, Gyne-Cytology Laboratory, Royal Victoria Hospital, Montreal, and C. G. Grand, Biology Department, New York University.

"A Home Constructed, Versatile, Portable Photographic Unit"
John Fallon, M.D., Fallon Clinic, Worcester, Mass.

"Somatotypes, Equipment and Procedure"
Philip H. Mott, Director, Audio-Visual Department, Queen's University, Kingston, Ontario.

"Preliminary Determination of Quantity and Quality of Illumination for Photomicrography"
R. P. Loveland, Kodak Research Laboratories.

"Problem of Medical Photography from the Standpoint of the Hospital Administration"
Frank C. Sutton, M.D., Director, Rochester General Hospital.

"The Increasing Stature of the Medical Photographer"
C. Graham Eddy, Chief, Medical Illustration Division, Veterans Administration.

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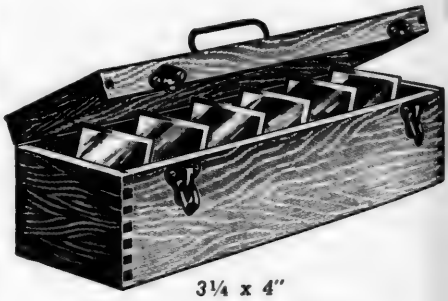

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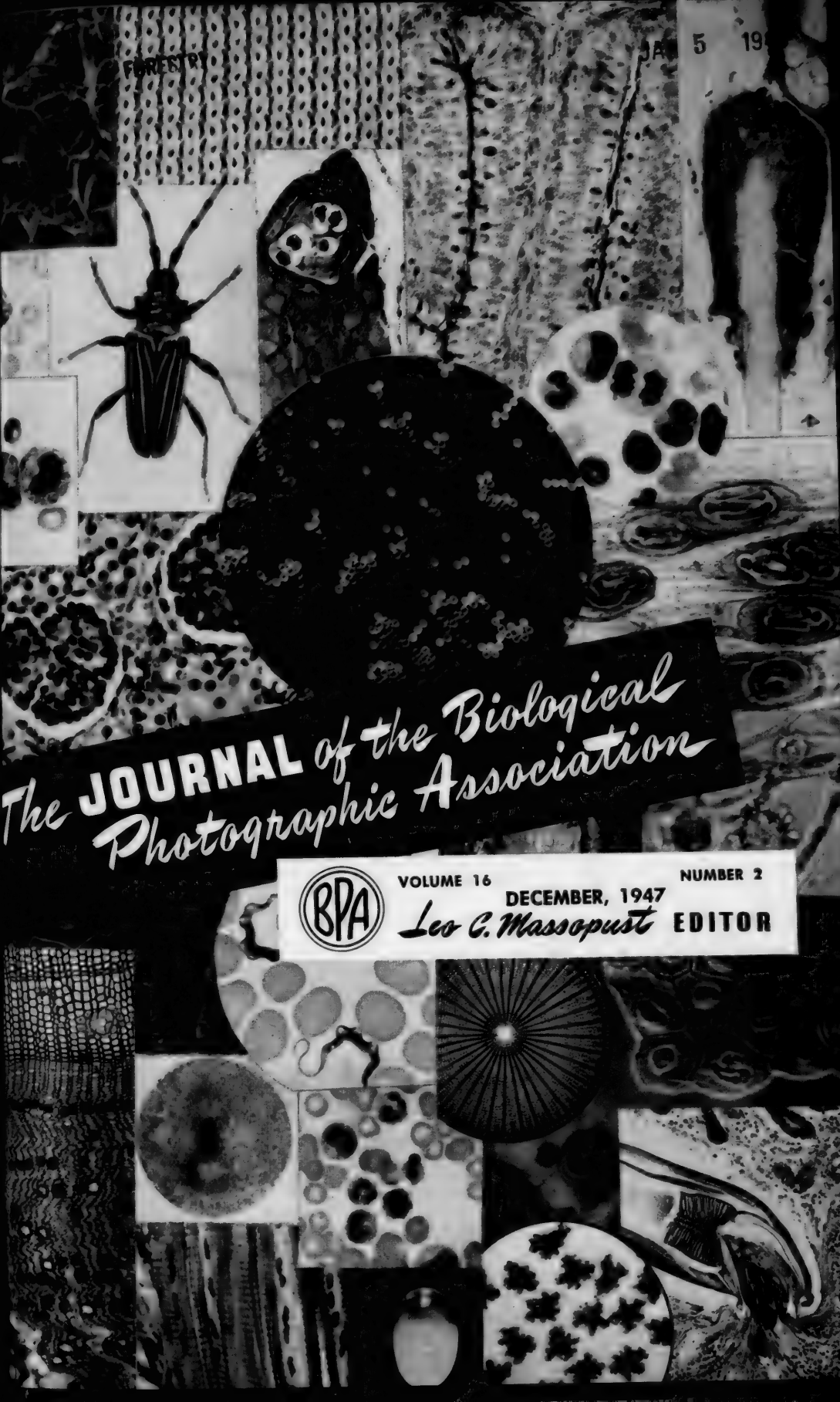

The JOURNAL of the Biological Photographic Association

VOLUME 16 NUMBER 2
DECEMBER, 1947
Leo C. Massopust EDITOR

Again we are entering the holiday season, with its message of peace on earth, toward men of good will.

The officers of the BPA and the staff of the Journal extend to all members and subscribers a hearty wish for a Merry Christmas.

We are looking forward to a bright, prosperous New Year, and to the 1948 BPA Convention in Philadelphia next September.

The JOURNAL of the Biological Photographic Association

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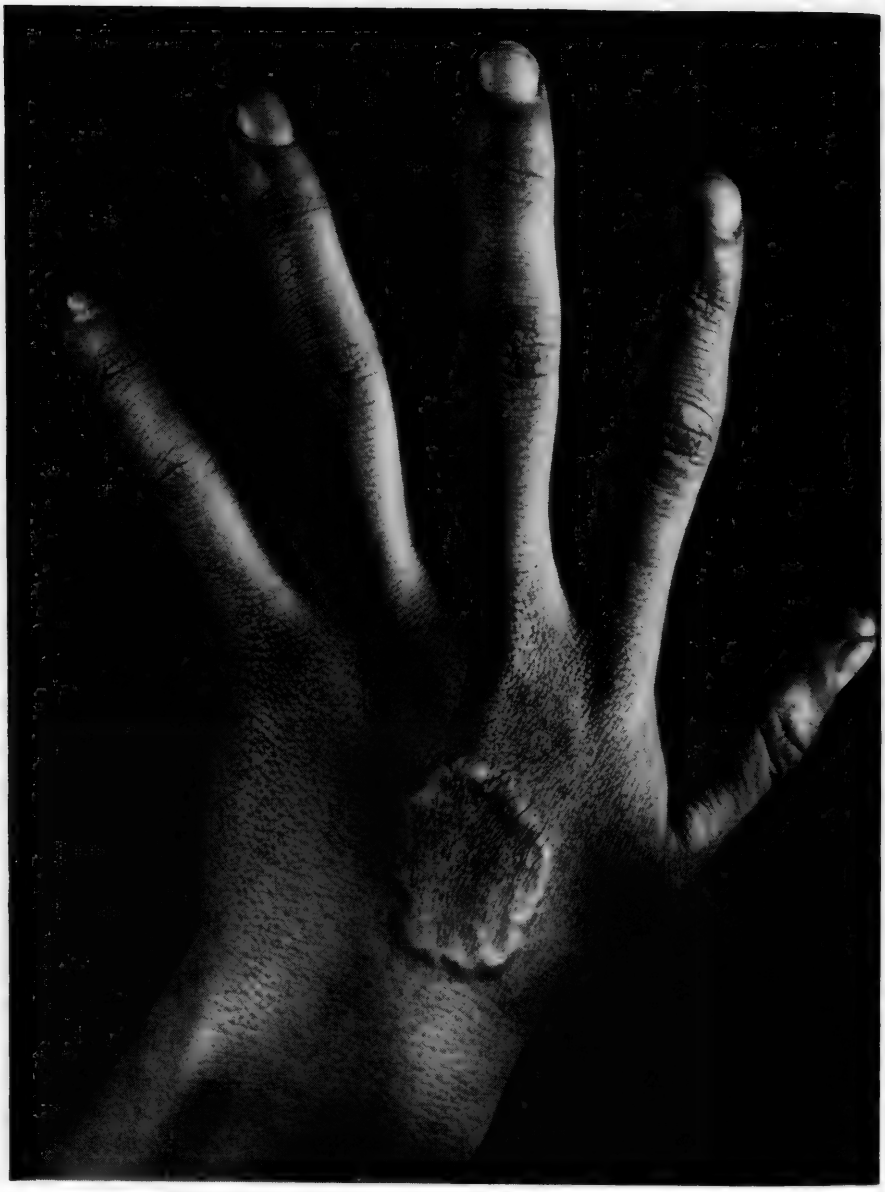

Figure 1. Granuloma Annulare.

Some Observations on Dermatological Photography

Peter Hansell, M.R.C.S., L.R.C.P., A.R.P.S.

AN exhaustive commentary on the subject of recording skin conditions is not implied by the title of this paper, and it is proposed rather to confine its scope to a few remarks prompted by a scrutiny of many present day dermatological photographs. Although a fair number of originals have been examined, a far greater wealth of material has been found in the form of textbook illustrations; in the latter case, however, due allowance must be made for the degradation of detail which occurs in many photo-mechanical processes. Even so, the value of such records is often impaired by inherent lack of quality; this state of affairs being far from irremediable, for attention to a few small points is amply rewarded.

Materials

In England, a considerable proportion of this type of recording is done in monochrome,—whether or not this is due to a relative shortage of materials, coupled with difficulties in processing, is still a matter for conjecture. If the position is viewed a little more critically, however, the most ardent enthusiast will admit that, at present, color photography offers merely color contrast, and not true color. Furthermore, restricted latitude and negligible control over the finished result during processing, are but two factors which make color material inferior to the various types of monochromatic emulsion.

Orthochromatic material is undoubtedly the one of general choice for recording skin conditions. Almost invariably the color of these external lesions is in terms of pinks and browns, and with suitable choice of developer and paper, the red end of the spectrum is not glaringly misrepresented. There are occasions, of course, when deepening of the red tones is very necessary: this is particularly true of the faint transient type of eruption.

Departing from this generalization, it is interesting to note that the panchromatic emulsion has many supporters in this field. Naturally, each case has to be assessed on its own merits, but apart from the preparation of separation negatives and a few other special instances, it is difficult to obtain results with filters and panchromatic material, which

Received for publication October 6, 1947 from the Department of Medical Photography, Westminster Hospital, London, England.

can be confidently repeated at some later date. A thorough knowledge of individual filter characteristics is essential, and, on the whole, the procedure is apt to become time-consuming: without filters the particular color-range involved is falsified to a serious degree.

There are obviously other special coatings which deserve mention, particularly those for ultra-violet and infra-red work; but these are outside the scope of the present article.

Technique

Records of skin lesions are often inadequate because of a distressing compromise between the close-up and the general view. Whether this is motivated by a sense of false economy is difficult to determine, but at least a leaf could be borrowed from the book of the film-producer in this respect. In a motion picture, it is conventional to show a general view, followed by a close-up if detail is to be observed. The same technique can be applied with advantage to the subject under discussion: the general view is essential in many cases, and may be thought of in relation to the *distribution* of the disease. Where the lesion is single, enough of the surrounding anatomy should be included to permit rapid orientation and estimation of size; if attention is not paid to this point, a portion of an arm may be taken for a leg and vice versa.

The close-up view is strictly complementary to this, and should aim at presenting maximum *detail.* It should include only the lesion, or a characteristic selection if more than one be present. The criterion of definition should be based upon an adequate rendering of hairs, pores, and scales, which in itself calls for first-class equipment.

Lighting will ultimately determine the texture of the subject, but it is surprising how often flat, lifeless pictures are tolerated when, with a little imagination, they could be made so much more valuable. As a fair amount of recording is done in color, it is possible that the type of lighting used for color work has been responsible for this deleterious effect. It is the duty of the photographer to demonstrate clearly even minor elevations (wheals, papules, vesicles, and pustules) and depressions (pits, scars, and ulcers) in the final result.

If dermatological photography is to stimulate the imagination of the worker, some artistic license is permissible if not desirable. Too little attention is paid to the preparation of the subject for photography, and the following few points have been found valuable in practice.

It is very usual for patients to attend a skin clinic besmeared with unctions of various kinds: cleaning of the area is therefore an essential first step from every point of view. Heavy, greasy bases may be removed with a light oil, or in certain cases, with ether. If serial records are to

Figure 2. Acne Vulgaris.

be made during a course of treatment, it is often wise to instruct the patient to clean the skin the day before attending the photographic department. Needless to say, this cleaning should be performed gently, and care should be taken not to remove scales and crusts as these form an important feature of the clinical picture.

The application of a trace of light oil will do much to improve the general appearance, and indeed when a broken skin surface is not involved, the author has frequently used a mixture of 5—10% Paraffin in Ether for this very reason. Application of this fluid to the skin will impart both luster and a slight translucency. In the finished photograph, a pleasing and lifelike sheen will be apparent, and unoffensive leader highlights will indicate even the smallest irregularities of surface.

The gentle friction occasioned by the application of oil or cleansing substance, will in itself serve to accentuate many lesions. Plain rubbing of the skin surface with the finger-tips is particularly useful when it is desirable to obtain a sightly exaggerated impression of faint rashes,—an example of this is afforded by the erythema group of afflictions.

Other techniques.

The useful application of ultra-violet and infra-red photography to dermatology is very limited, and hence only a few remarks are merited. It is sufficient to say that many superficial and ill-defined lesions may be demonstrated with artificial clarity by employing straight ultra-violet photography. Fluorescence photography falls into a totally different category and would only be of doubtful value in certain fungous infections.

For infra-red work, on the other hand, many of the commercial filters available are useless for skin recording: it should be realized that it is the near infra-red region of the spectrum which is of interest in this connection—it is the rays in this region which are capable of the greatest skin penetration. Many experimentalists claim that up to 2 or 3 centimeters of skin and tissue can be traversed, but practical experience seems to indicate that the effective penetration of infra-red rays, from the recording point of view, is only one to three millimeters, (the depth of the hair follicles).

Bearing this in mind, it is easy to see how infra-red photographic recording may be used to demonstrate the relative superficiality of a lesion, and may further be of value in assessing progress beneath a crust or scab. (Lupus vulgaris).

These special techniques still operate largely on an empirical basis, for precise measurements are difficult in the course of everyday photo-

graphic practice; used with discretion, however, they may serve a useful purpose. Less empirical is color photography, which has been briefly mentioned; it is capable of slightly more measured control though is still possessed of many defects. At the end of the scale, straightforward photography in monochrome is encountered, and even today it has a great deal to commend it—the degree of control which it is possible to exercise at every step in the process must appeal to the exacting worker. The point at which the same can truthfully be said of records in color has not yet been reached, and until it becomes necessary to abandon the conventional black-and-white picture, it would be as well to consider the improvements which are needed in existing methods.

Professional and Layman in Biophotography

John Fallon, M.D.

YOU cannot have attended a B.P.A meeting without perceiving that our Society constitutes a unique phenomenon: a peaceful mixture of professional and layman. "Layman", of course, is used in its modern meaning of anyone whose job differs from your own. The chemist, the physicist and physician do not think of the photographer as an invader any more than the professional photographer calls the physician a snapshotter. Together we are compounding a new science, blent of contributions from each. And such differences as we have derive from growing pains, not guild jealousies.

Inevitably leadership, which worries none of us now, will gravitate to the man with photographic training. It is he who has the technic. He does the work. He will make the discoveries.

He can learn the theory of biology. He is learning it, today, by application and adsorption. Tomorrow he may be taking an M.S., or M.D. or Ph.D. as a start along the road. But for today no one worries about degrees, we're all beginners together and everyone has a good time. This is a reward reserved for those men—and women—who are in on the ground floor of a young science. Although, when you come to consider, it's not so young as it used to be. For the camera has begun to do, as well as to record, biologic research.

Book Reviews

"THE YEAR'S PHOTOGRAPHY, 1947-48". A Royal Photographic Society of Great Britain publication.

The September number of the Royal Photographic Society Journal contains a selection of very fine illustrations of pictures taken by photographers from England, India, Australia, America and many other countries. Pictorial work predominates, but natural history and record pictures are also much in evidence. The high standard of this Annual seems to keep up year after year in spite of all of the never-ending shortages of materials necessary to photography.

Mr. Bertram Sinkinson, F.I.B.P. (Fellow) presents an interesting commentary on the pictorial work shown at the Annual Exhibition of the R.P.S. The lantern slides of the Exhibition are ably discussed by Mr. J. S. Waring (Fellow) and the nature section is given over to Mr. Olin G. Pike, F.I.B.P. (Fellow). His discussion also is excellent.

It is an annual pleasure to review "The Year's Photography", and to view the fine reproductions of beautiful prints that it contains.

RAY MIESS

THE AMERICAN ANNUAL OF PHOTOGRAPHY, 1948. Volume 62. Edited by Frank R. Fraprie and Franklin S. Jordan. American Photographic Publishing Company, Boston, Mass. Paper, $2.00, cloth $3.00

One of the early signs of the approaching holidays is the annual appearance of this always interesting volume.

In the first article Editor Fraprie, in a reminiscent mood, goes back and reviews his photographic career. Among the many things mentioned was a former Salon, in which one exhibitor exhibited forty-seven prints! Fortunately we are down to earth now with our present limit of four. Fraprie's article is well illustrated with some of his most successful exhibition prints. John W. McFarlane lets us in on the tricky method of making photographic "exploded" views. Herbert C. McKay and Jack Wright are very convincing with their respective articles, "The Art of Exposure" and "Hints on Success in Color". Albert E. Marshall brushes away some of the old fashioned ideas with "All That's Bright Must Fade?" Raymond J. LeBlanc has a very practical idea in Sensitometry and you should enjoy "A Philosopher's Notes of Photography" by Ellen R. Walker.

There is the usual section of illustrations from workers in every part of the world,—all carefully chosen, and representative of the best in photographic practices. There is also an excellent commentary on each picture in another section. William Steeple Davis explores the "Pictorial Possibilities of Bridges" and Thomas H. Miller tells you why, how, when and what film to choose for the type of work you are attempting.

For those interested in "the score", "Who's Who in Pictorial Photography" in 1946-47 will keep you posted. (Editor Fraprie mentions in his first article that if he knew how much work his tabulation was going to be, they probably would never have started it.)

The last few pages of this Annual are used in listing most of the Amatuer Photographic organizations in the United States and in many of the foreign countries.

RAY MIESS

The Role of Medical Photography in the Hospital

Frank C. Sutton, M.D.*

IN hospital circles medical photography is receiving increasing attention. Its value is being demonstrated in a wide range of practical applications. It is predicted that medical photography will become recognized and established as an essential adjunct service in the modern hospital. Doctors quickly grasp the importance and the possiblities of photography in medical practice. Their interest is demonstrated by the extent to which they utilize this service when available in the hospital and by their suggestions of new uses in which visual records are of benefit. Recent improvements in photographic equipment and the training of experts in medical photography are also enlarging the scope of usefulness of photography in the hospital. The principal uses of photography which are of practical value in the hospital relate to major activities of vital concern to every hospital administrator.

Case History

Hospital directors and allied professional organizations are constantly striving to improve the quality and completeness of medical records. Good photographs in selected cases are now becoming recognized as important and often vital adjuncts to the patient's medical record. As a form of visual shorthand, pictures instantly convey to the physician information which cannot be derived from other media of expression. A good photograph eliminates lengthy written description, thus simplifying the record. In an ever-widening range of cases medical photographs serve to substantiate the clinical diagnosis, to indicate progress and to record the end-results of treatment. Examples are skin diseases, endocrine disturbances, neurological conditions, developmental anomalies, plastic surgery, external injuries, superficial tumors and gross or microscopic pathological specimens from surgery or post-mortem. Photographs provide significant medico-legal evidence which may be of decisive importance in protecting the hospital and the physician against fraudulent claims. Properly cross-indexed and filed, they provide a permanent record for reference in the future care of the patient.

*Medical Director, Rochester General Hospital, Rochester 8, New York.
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Thus they serve both to simplify and to enhance the value and completeness of the medical record.

Medical Education

In all hospitals, particularly those providing training for interns and residents, a continuous teaching program must be maintained. Responsibility rests upon the hospital administrator for the standards of education which his hospital provides. The value of visual aids in education is now well-established. The application of medical photography in the teaching of the medical staff, interns, nurses, and technicians in the hospital is one of its most important uses. The introduction of color photography in medical staff conferences provides a striking example of its advantages. Formerly, discolored and foul-smelling pathological specimens were passed around the conference room for individual inspection. Since the speaker was usually discussing another subject before the specimen had reached many hands, little benefit was gained from the demonstration. Today, photography provides lantern slides in color transparencies which can be viewed simultaneously by the entire audience while the speaker points out special features of each slide. Pertinent information, such as x-rays, electrocardiograms, charts, tables, drawings, and gross and microscopic pathology, may be shown by lantern slide. In addition, photographs of the patient may be included, thus eliminating the problems and objections of bringing the patient to the conference room. Conferences are speeded up and more variety is introduced. With the aid of photography as described, medical staff conferences which were otherwise dull and poorly attended have been transformed into interesting, well-attended conferences of high educational value. The same advantages apply to the clinical-pathological conferences, journal club meetings and seminars for interns and residents. Other time-saving uses of photography include lantern slide demonstrations of typical nursing procedures, preparation of operating room and delivery room, surgical instrument setup, emergency room technics, blood transfusions, and many other similar examples.

Research

Today people seem more inclined to give funds for research than for new buildings or hospital deficits. The present emphasis is on research in heart disease, cancer and other leading causes of death. As a result more hospitals are conducting research projects. Carefully classified and permanently filed, medical photographs provide an invaluable reference in clinical research studies. In many instances verification of the diagnosis, evidence of progress, and an accurate check of

results of treatment are better studied by photographs than by any other method. The use of color, particularly, affords an accurate and life-like reproduction which preserves the characteristics of the original subject. Apparatus used in experimental research and various steps in technic may also be demonstrated to advantage by pictures. In addition to the scientific accuracy of photographic illustrations in research, a significant factor is the saving of time.

Publications, Exhibits, Etc.

The universal application of photography in popular magazines has extended to scientific publications—with decided benefits. An important function of the medical photographer in the hospital is the preparation of charts, x-rays, and photographs for illustration in professional journals and scientific exhibits. Those who recall conventions and scientific journals in the days before general use of photography often comment upon the improvement which liberal illustrations provide.

Public Relations

Hospital administrators are becoming increasingly aware of the value of good hospital public relations. One of the most effective ways of telling the story of the hospital is through the use of well-selected pictures. Today they are considered indispensable to successful hospital publications, such as annual reports, nursing school bulletins, information booklets for patients, and employee magazines and manuals. Exhibit cases are being utilized in main corridors to demonstrate the importance of hospital and health activities by the use of photographs. The medical photographer in the hospital is often called upon to take pictures at student nurse graduation exercises, presentation of special awards to employees, intern groups, building alterations, new equipment, and many other similar situations.

Medical photography may prove of value in unexpected ways. For example, at the Rochester General Hospital the rapidly growing file of photographs of pathological specimens, now totalling nearly 10,000, raised questions as long ago as 1942 concerning the value of the pathological museum. It was felt that the time-honored practice of preserving specimens in glass jars could be abandoned and replaced to advantage by the "photographic museum" which had gradually developed in the compact file of photographic slides. As a result the traditional pathological museum of preserved specimens was discontinued and the much-needed space converted to the tissues' section of the laboratories. In the adjustment more space was found for the hospital's School of Medical Photography to the satisfaction of everyone concerned.

The establishment and operation of a department of medical photography in a hospital is neither difficult nor expensive. It can be started on a small scale with simple, inexpensive equipment and developed gradually as conditions warrant. One word of warning: Do not make the mistake of assuming that a complete layout of expensive photographic equipment will guarantee a successful department. A properly trained medical photographer is the most important consideration. He should be provided a salary commensurate with his advanced technical training. If necessary, arrangements can be made to have one medical photographer serve several small hospitals at a satisfactory salary representing a very nominal cost to each hospital. For the benefit of the medical photographer the department should be under medical supervision and the hospital pathologist is usually the person best qualified. He is most often present in the hospital and readily available for advice when questions arise concerning a photograph. He is familiar with the pathological specimens that will be photographed daily. He can best determine what is medically important in the selection of proper material or subjects. However, if the department is to be a success, it is important that the medical supervisor be chosen on the basis of his interest and aptitude in the application of photography in the hospital. The hospital radiologist or a physician on the administrative staff may be assigned to supervise the department of medical photography if he is the one most interested in its development.

Photographs of patients should not be taken without written consent for their use in medical conferences, scientific journals, etc. In such uses recognition of the patient should be obscured by dark glasses or other means and his name should not be divulged. Emphasis should be placed upon photography of ordinary clinical material. It is a mistake to limit photography to rare clinical entities which yield too little in practical results in relation to the cost. Although it is to be expected that a fee schedule will be established for most photographs, there will be many for which a fee cannot properly be charged. The hospital administrator should consider the introduction of medical photography in the hospital primarily from the viewpoint of its advantages in better medical records, teaching, research and public relations rather than its income-producing possibilities.

Until recently medical photography has been limited essentially to medical schools and university-affiliated hospitals. Its practical advantages can now be demonstrated in a variety of ways in every type of hospital. An investigation of this new service will amply reward the hospital administrator who is seeking to improve medical records, teaching programs and public relations in the hospital.

For discussion of Dr. Sutton's paper see Association News, page 94.

A Surgical Photographic Truck

John Fallon, M.D.*

THE general practitioner who does his own surgery is not ordinarily asked to speak before surgeons. Consequently a surgeon who does his own photography, albeit from necessity not choice, feels no little embarrassment in writing for professional photographers.

This surgical photographic truck consists of a storage locker, work bench, camera stand and light bank combined into a hand truck the size of a small table. It is pushed around the hospital and, extramurally, transported by station wagon. It carries equipment for photographing groups, patients, operative fields and specimens; for macrophotography, photomicrography and endophotography through either lensless or lensed endoscopes. It can be used as a projection stand, an enlarging stand or a cinematic dolly.

The general design is illustrated in Figure 1. This is not a perspective but a scaled isometric drawing: measurements can be taken from it as from a plan. Sturdy material, good joining and metal bracing are advisable if the truck is to be used for photomicrography or as a dolly . The surface is finished in the ordinary black char stain of laboratory table tops. Wiring and insulation are heavy and there is a spark proof master switch.

Most of the apparatus is explained by the illustrations but certain points need amplification. The locking drawer is compartmented to hold odds and ends, accessories and cameras (a standard 35 mm. range finder camera, the basic machine; a 35 mm. reflex; a McClure proctoscopic camera[1]). This drawer can be removed for transportation outside the hospital, but accidental withdrawal, an expensive accident, is prevented by a turn button on its back. The large lower shelf carries the handlight illustrated in Figure 7, a box of background paper, batteries and control panel for the McClure lighting system. In cleats on the small shelf above the control panel is stored the wooden shelf, shown in Figure 1, in position near the top of the camera stand. This shelf holds a small still projector above the heads of an audience in an unslanted hall. It is too shaky for cinema projection. Although designed for stills, the truck has been used as a none-too-steady cinema dolly by guying the mast, mounting the camera on the projector stand and putting an opera-

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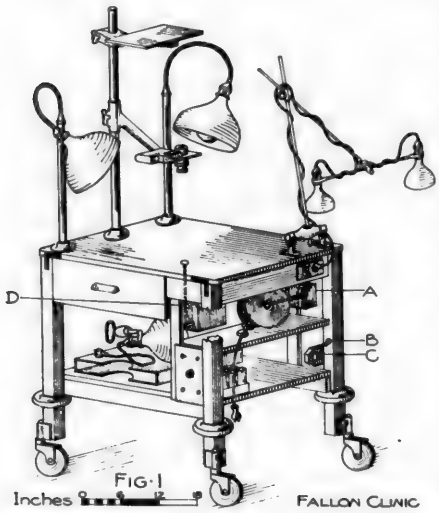
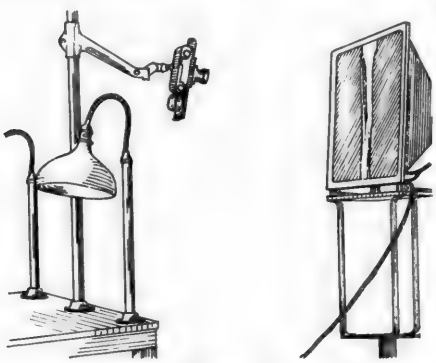
*Surgeon, Fallon Clinic and St. Vincent Hospital, Worcester, Mass.

[1] Dr. Charles W. McClure, 520 Beacon Street, Boston, has not yet published.



tor's chair on the table top: The jointed light arm shown in Figure 4 is used only rarely and ordinarily is stored in brackets on the frame B, Figure 1. The arm now is used only in conjunction with the goose-necks to light a large area. There also are brackets, C, Figure 1, to hold the mainmast of the camera stand when it is dismounted for transportation. A, in Figure 1, is the spring reel of the electric lead and D the pull rod operating the master switch.

Copying and macrophotography ordinarily are done on the table top but a universal joint allows other applications, Figure 2. Photographs through specula and lensless endoscopes are made by the set-up shown in Figure 3. Latterly the McClure camera has been preferred for practoscopic work. For work with lensed endoscopes the eye shield of the endoscope and lens barrel of the reflex camera are removed, and the camera body, with ordinary photomicrographic cone attached, is joined to the endoscope by half a rubber


FIG·2

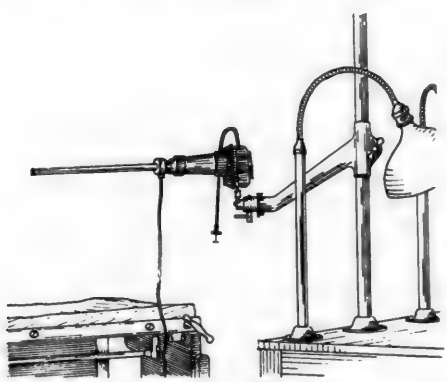
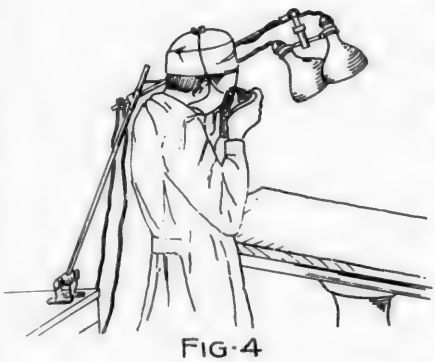

FIG·3

Figure 1. Surgical Photographic Truck. Reference letters are explained in the text.

Figure 2. Copying and Macrophotography of object which cannot be photographed on the table top.

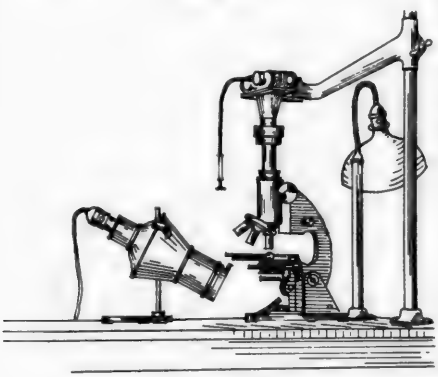
Figure 3. Endophotography (Lensless Endoscopes). Extension tube. 105 mm. lens. Also applicable to macrophotography at the operating table.



FIG·4

ball perforated to pass the endoscope's head, Figure 6.

The pictures which surgeons desire most are pictures of operative fields, because these can show living lesions unspoiled by removal or even handling. If the surgeon himself must take the pictures—i.e., if he cannot afford a biophotographer—an utterly simple technic is essential. I use the range finder camera supplemented by a standard accessory consisting of an extension tube equipped with compensators for range finder and field finder. This takes, by snapshot, a field of ap-



FIG·5

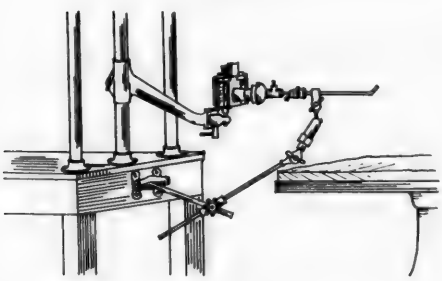


FIG.6

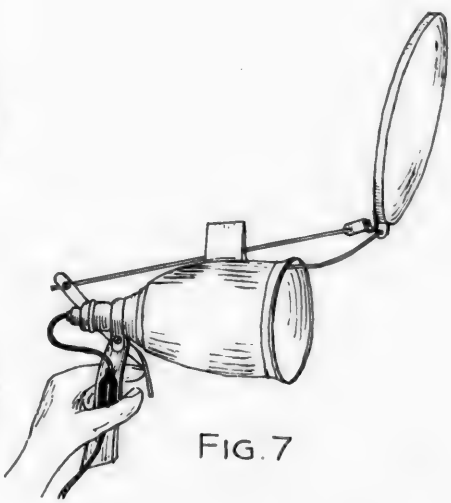


FIG.7

Figure 4. Extra Light Arm. Use of this arm at the operating table has been almost completely replaced by the handlight (Figure 7). Its current use is to make a 6-light bank with the goosenecks and 2 handlights.

Figure 5. Photomicrography. Standard microscopic adapter. Rubber pads under wheels.

Figure 6. Endophotography (Lensed Endoscopes). Reflex camera. Standard microscopic adapter. Half rubber ball.

Figure 7. Handlight. Movable diffusion screen. Self contained switch.

proximately 6 x 9 inches at an object distance of 17 inches. The primary, usually the only, light source is the hand light shown in Figure 7. Occasionally one of the gooseneck lights or a focusing spot which can be attached to the mainmast add secondary lighting. If, occasionally, more diffused light than that of a frosted photoflood is wanted a silk screen is available. The screen is mounted on an embroidery hoop and controlled by the trigger shown in front of the handle. There is a switch on the handle. The camera is manipulated by one hand, the light by the other.

Obviously such a jack of all trades as this truck is designed for amateur, not professional, standards. But obvious adaptations might prove practical for those who do much work in the operating room or visit more than one hospital.

The Physical Principles and Techniques of Autoradiographs[1,2]

George A. Boyd*

SINCE the first bomb dropped on Hiroshima newspapers have printed accounts of the great future of radioactive elements in the field of medical research. We know these have numerous therapeutic and research applications. This article deals with *one* research application which, with the proper latitude of definitions, falls within the field of medical photography.

This application can be classified as biological photography in that we use gross anatomical or histological sections in taking their own "photograph" on a silver bromide emulsion even though we do not use a camera. In some hospitals and research institutions the man who is familiar with photographic processes is sometimes asked to collaborate in this work of autoradiographs, and because of this, it seems appropriate to present something about the basic physics of the methods.

We now have available radioactive potassium, sulfur, iodine, carbon, and other elements which are important in the metabolic processes of the body. Through their radioactive characteristics we are learning much about how these elements and the molecules containing them function in the body. The Geiger counter has been used for several years as a means of detection and measurement. The photographic plate is now coming into use, although historically it is older than the electronic methods. The purpose of autoradiographic research is the location of a particular atom in a gross or histological section.

To better understand the principles of autoradiographs, let us review our knowledge of radioactivity as it pertains to this subject.

Radioactive elements emit three types of rays, alpha, beta, and gamma. These are given off from the unstable nuclei of the atoms in question. While all of these rays will affect a photographic emulsion, we shall concern ourselves only with the alpha and beta since these are easier to detect and at least one of them is always present in any radioactive element. We must consider the alpha and beta rays sepa-

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* School of Medicine and Dentistry, University of Rochester, Rochester, New York.

[1] A condensation of a lecture given before the Biological Photographers Association at Rochester, N. Y., September 12, 1947.

[2] This document is based on work performed under Contract No. W-7401-eng-49 for the Atomic Energy Project at the University of Rochester.

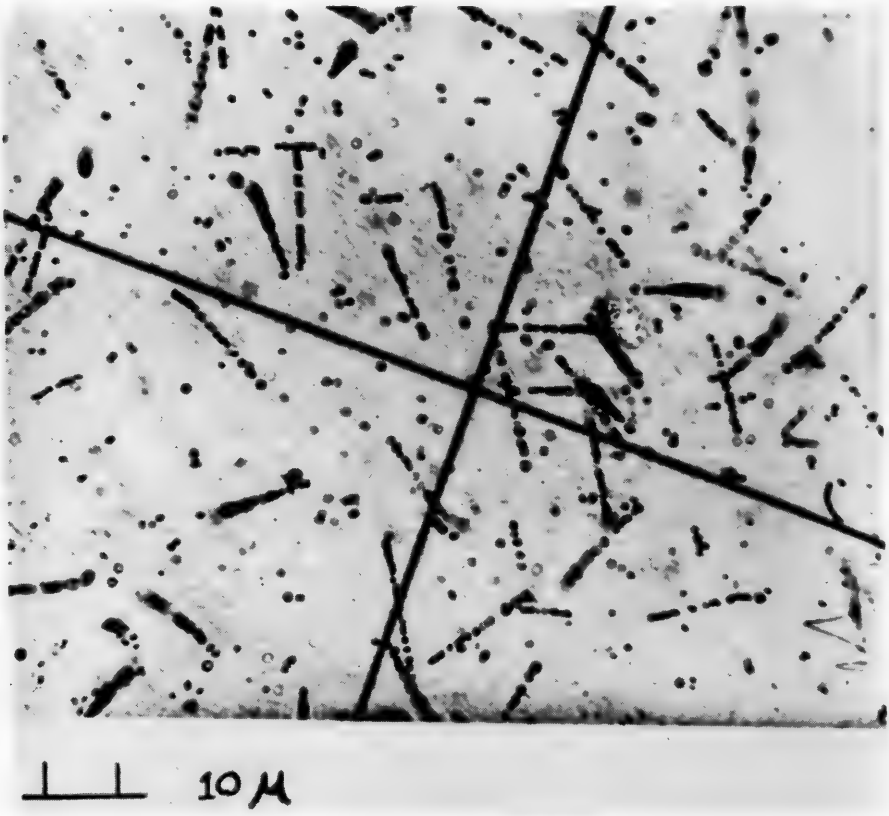

Figure 1. Alpha tracks from polonium. Eastman NTA Plates.

rately because of their different characteristic reactions in the photographic emulsion. Hereafter, we shall refer to these as alpha and beta particles since they are emitted as discrete bodies.

We wish to consider these two particles separately for another reason. The alpha particles are emitted only by the elements of the higher atomic numbers, for example, plutonium, uranium, polonium, etc. These elements are used in the manufacture of the atomic bomb, and some of them would be present in the air and on the ground after a bomb explosion if we have an atomic war. Since they would find their way into the body through food, water, and dust, where they would destroy the tissue, the medical profession is interested in studying the metabolic processes of these elements by locating them in the tissue and, if possible, within the cell itself. The fact that alpha particles are emitted from the nucleus of the atom and affect a photographic

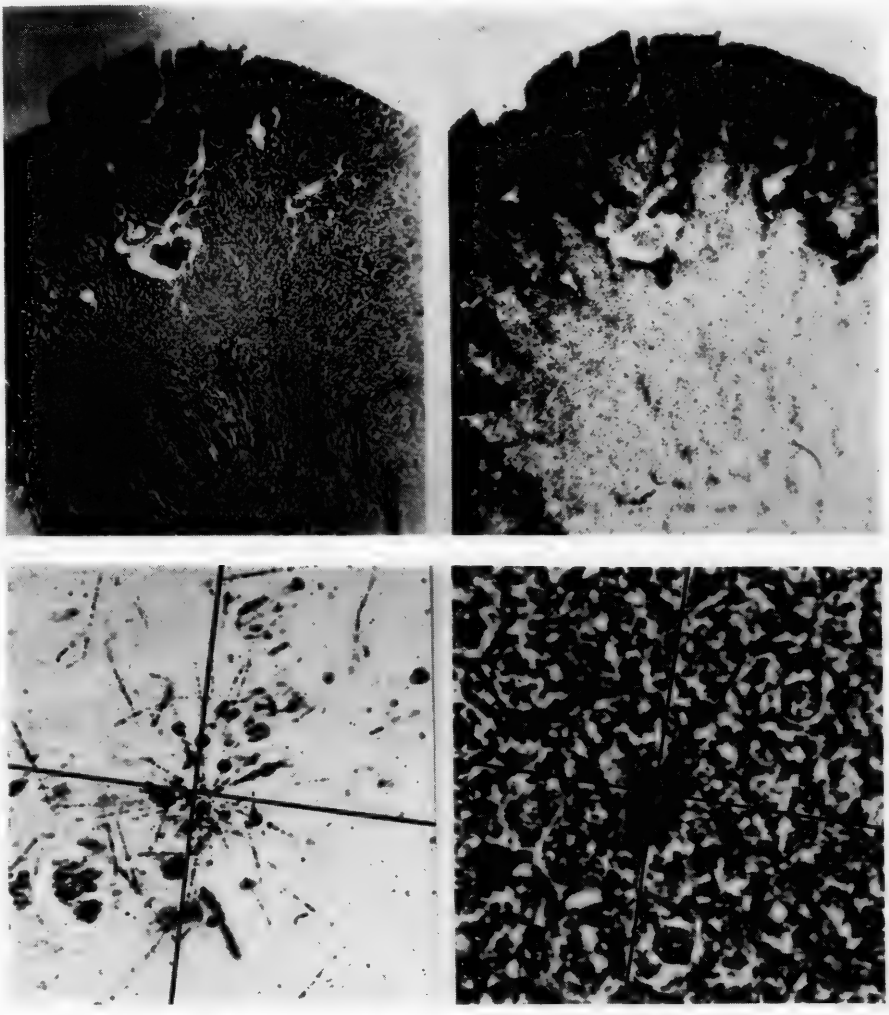

Figure 2. (a) Section of rat kidney containing polonium. c 20 X. (Top left)
(b) Corresponding autoradiograph on Eastman medium lantern slide. c 20 X.

Figure 3. (a) Photomicrograph of an unstained rat liver section containing polonium. Taken with the Bausch & Lomb phase microscope. c 1500 X. Shows a capillary at the intersection of the cross hairs. (Bottom right)
(b) Bright field photomicrograph at about 5/U below (a). c 1500 X. Shows a collection of polonium alpha tracks at the intersection of the cross hairs.

plate, enables us to use the autoradiograph for this purpose. These radioactive elements occur naturally, although some, plutonium for example, are also made by the pile.

The second category of interest comprises the beta-emitting elements found in the natural metabolic processes of the body. The radioactivities of these are induced by cyclotrons and by the pile at Oak Ridge. We are now able to produce large quantities of these elements and their beta particles also affect a photographic plate. By this means, one can administer a radioactive element and locate the point of deposition in a tissue. For example, we can show by autoradiographic means that radioiodine goes to the thyroid gland and, furthermore, can show that it goes to certain portions of the gland. It is this group of elements that offer great possibilities in medical research.

An alpha particle is a doubly positive charged body containing two neutrons and two protons given off from an atom's nucleus. It is four times as heavy as the nucleus of a hydrogen atom. The beta particle is an electron. Its only distinction from this common electrical particle is that it is emitted from an atomic nucleus. It has the mass and negative charge of the electron.

A photon hits a silver bromide grain and through some mechanism, which is not entirely clear, puts the grain in a proper energy state

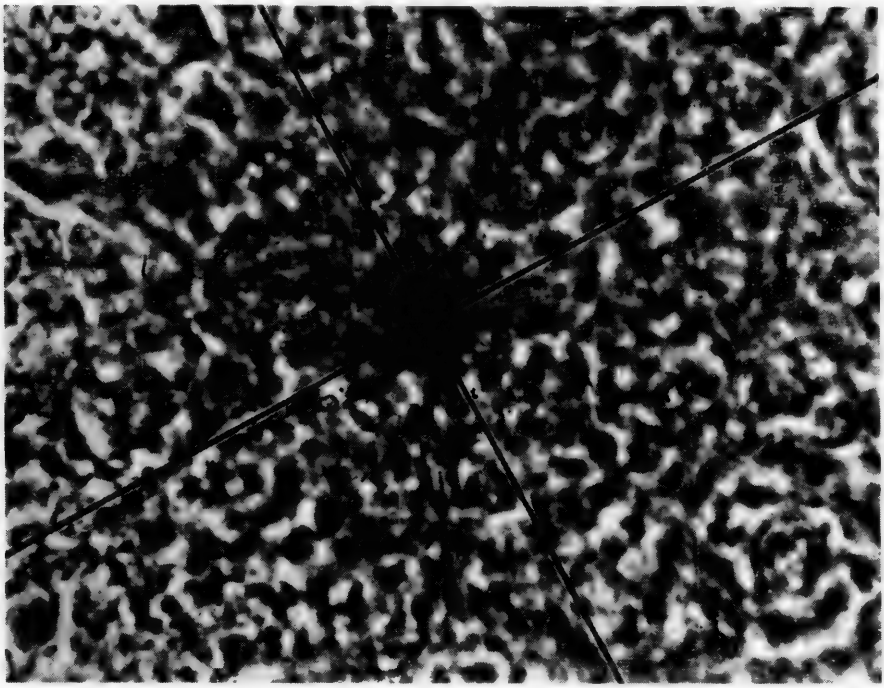

Figure 4. Bausch & Lomb phase photomicrograph of alpha tracks, i.e., looking through the tissue to the focal plane of the alpha tracks in the photographic emulsion. c 2000 X.

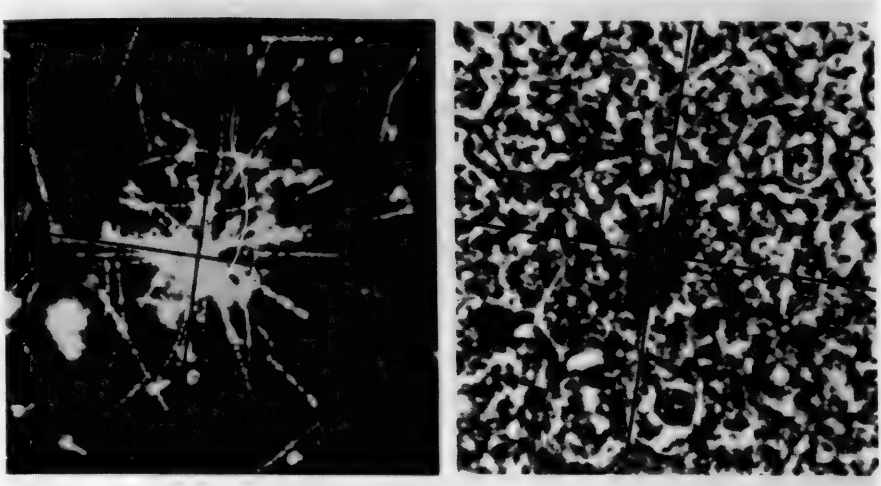

Figure 5. (a) Photomicrograph of an unstained rat liver section containing polonium. Taken with the Bausch & Lomb phase microscope. c 1500 X. Shows a capillary at the intersection of the cross hairs. (Top right)
(b) Dark field photomicrograph at about 5/U below (a). c 1500 X. Shows a collection of polonium alpha tracks at the intersection of the cross hairs.

so that it can be developed at some later date. In autoradiographs, the alpha particles and beta particles pass from the object, in our case the histological section, to the photographic emulsion and, as far as we know, react in a similar manner to make the silver bromide grain developable. However, the photon has no mass while the alpha and beta particles do. Moreover, the masses of the two particles are widely different and this poses a problem. The mass controls the velocity of the particles and this controls the probability of the reaction on the grain. Thus, because of the difference in velocities of the alpha and beta particles, the probabilities of developable grains being produced are widely different. The probabilities give us a row of grains in the emulsion for each alpha particle, but only scattered grains for the beta particle. More shall be said about this later.

Figure 1 shows tracks produced by alpha particles as they pass in a straight line through a photographic emulsion, producing a series of grains. These grains average approximately 0.8 of a micron in diameter. This photomicrograph was taken at about 1000 magnification.

You will notice that the tracks lie in all directions. This random distribution is characteristic of particles emitted from a nucleus. We cannot predict which direction the particle will take. This is true for

beta particles also. Furthermore, beta particles do not move in straight lines as do the alpha particles.

Note that these grains are very close together. This is not the case for beta particles, hence, in taking autoradiographs of a tissue containing, for example, radiocarbon, which gives off a beta particle, we must depend upon a random distribution of grains instead of discrete tracks. This difference is explained by the difference in velocities of the two particles as mentioned earlier.

If an alpha particle and a beta particle have the same amount of energy, the latter, because it is approximately 1/7,5000 as heavy as the alpha particle, will move very much faster since the energy, mass, and velocity are connected by the elementary equation $\frac{mv^2}{2}$ = energy. Now, since the beta particle is traveling at a much higher velocity it will not remain in silver bromide grain as long as a slower alpha particle. Because of this quick flash through the grain, the force of the beta particle does not always have time to produce the latent image. That is, the latent images produced are controlled statistically. Since the probability of producing the latent image is much less for the beta than for the alpha particle, the grains with latent images on them are farther apart than in the alpha track. In fact, the spacings are so great that one cannot say that any two grains are produced by the same beta particle. Furthermore, since the beta particles are light, they are deflected. You will remember from Figure 1 that the alpha particles go in straight lines. The beta particles, however, are deflected and may reverse their direction. Hence, one cannot see a track of a beta particle in the emulsion. This is unfortunate for the study of nuclear physics and in autographic work which shall be discussed later.

Since the beta particle is much more reluctant to give up its energy because of its rapid flight through the silver bromide grain, it can travel a much longer distance than the alpha particle. For the beta particle from some elements, this path length is calculated to be at about 2,000 micra. This limits the spatial resolution in autographic work since a point source in a tissue section would produce an image of 4 mm. in diameter. Most of the beta-emitters do not produce such a large image, but in any case, they are too large for cellular resolution.

It is a simple matter to take an autograph of a gross structure or histological section by placing them directly on the emulsion and later developing and comparing the autograph with the stained tissue if one does not attempt too high a magnification. For the gross structure, we are not too concerned with the resolution. For polonium, however, where the length of a track in the emulsion is $20/\mu$, a point source would give an image of approximately $40/\mu$ since the particles radiate

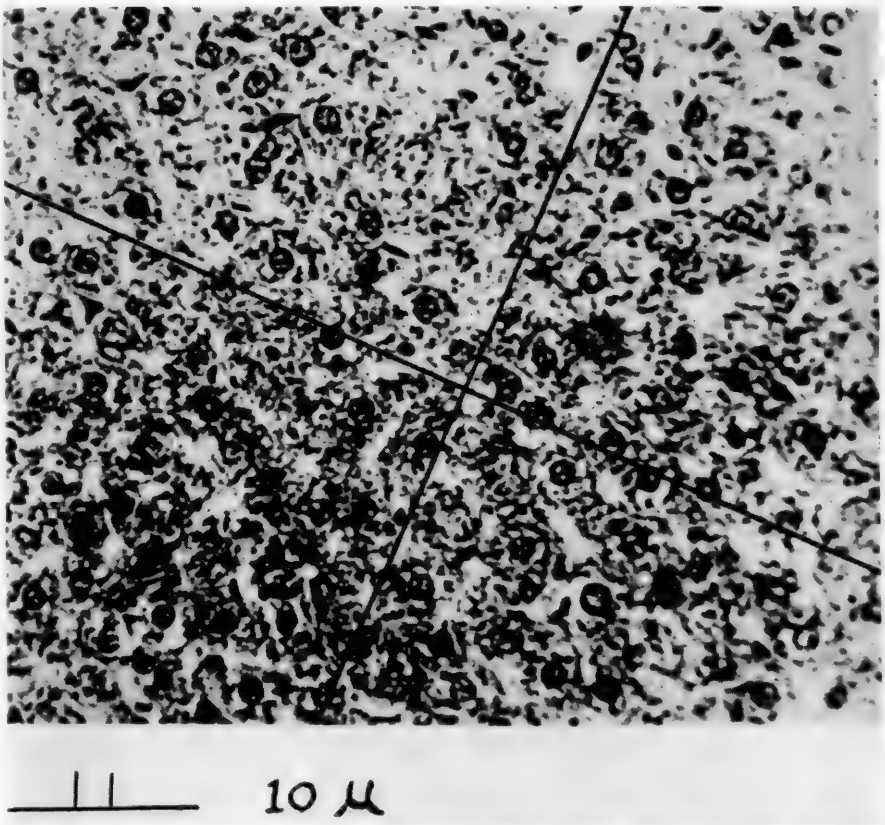

Figure 6. Photomicrograph of rat liver. Stained with hematoxylin and eosin. c 500 X.

in all directions. Thus, much better resolution can be obtained with alpha-emitters than with beta-emitters.

Figure 2 shows a photograph of a kidney section from a rat into which had been injected polonium and the corresponding alphagraph. These are magnified 20 X. At this low magnification one can learn something about the distribution of the element by such a method of side by side matching. It can be seen that the polonium is in the cortex of the kidney with only a small amount in the medullary area. However, one wishes to locate the elements much more closely. When these autographs are magnified to approximately 500 X to 1000 X it is impossible to make the proper correlation by placing the two photomicrographs side by side since recognizable histological structures are not produced in the autoradiograph. It is then that other means must be employed.

A very good method was developed independently by Endicott and Yagoda[1], Evans[2,3], and Field[4]. All of these experimenters worked with

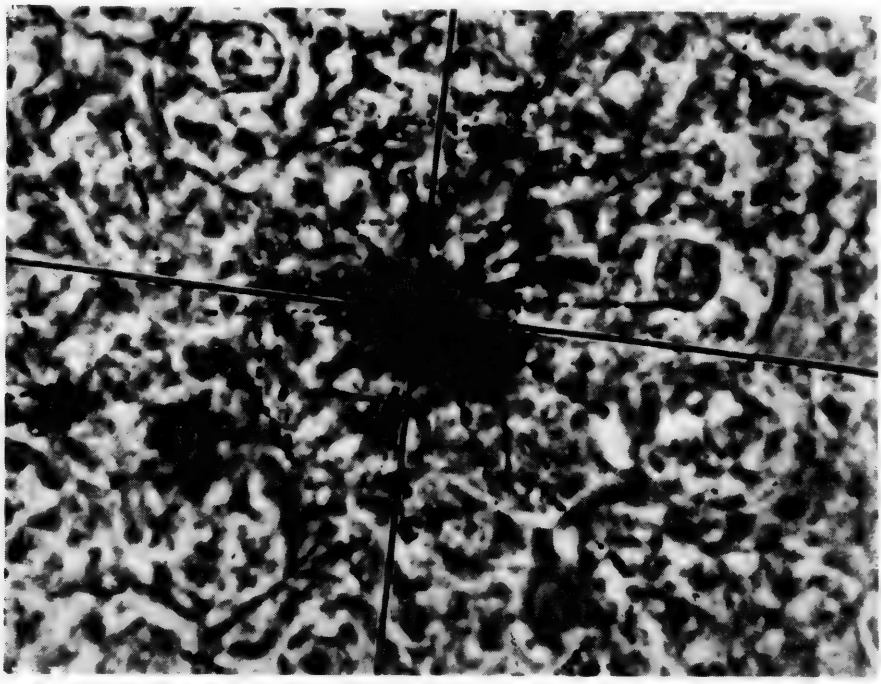

Figure 7. Alpha tracks of Fig. 5 (a) superimposed on a phase photomicrograph of liver tissue of Fig. 5 (b). The phase picture was toned in sepia on a lantern slide and the dark field picture of the tracks was printed on another slide. The two-tone transparency gives better contrast than when printed in black and white. c 1500 X.

alpha emitters with the exception of Evans who used the method for studying the location of radioiodine in the thyroid. Their general method was to use a photographic plate as the microscope slide and place the tissue directly on the emulsion. This, of course, is done in the darkroom. After the exposure, the plate was developed without removing the tissue. After development, the tissue itself was stained, again without removing it from the emulsion. This method has the advantage that perfect registry is obtained and that for very low concentrations or for short exposures with high concentrations one can locate the origin of an alpha particle track at the surface of the emulsion where it comes in contact with the tissue, and thus locate the element, which emitted the alpha particle, in a particular cell.

There is one disadvantage. The gelatin, being a protein, stains just as the protein of tissue does. This makes it difficult to see the tracks. This situation can be improved by destaining as has been done by Evans.

To overcome this disadvantage I have made use of the phase microscope which has become available in the last few years. This microscope enables one to see an unstained histological section due to

the difference in the index of refraction of the bodies in the cells. This, then eliminates the necessity of staining the tissue and the consequent staining of the emulsion gelatin and the obscuring of the image.

We have only recently started using this technique, and many improvements are still to be made, but the methods used to date are as follows: The tissue is imbedded in paraffin and 7/μ sections cut and floated on water. A clean microscope slide is slipped in the water under the tissue to lift it out. This is heated in an oven at about 40°C or on a hot plate until the wrinkles are smoothed out. This is judged by sight more than by temperature and time. The section is refloated on the water by slowly inserting the slide into the water at an angle of about 45°. Then in a darkroom the photographic plate is slipped under the tissue to pick it up. The excess water is removed by blotting with a fine grade filter paper pressed lightly and uniformly over the entire plate. The plate and tissue are now placed in a light-tight drawer or box for a few hours to dry. The drying could probably be done with a filtered current of warm air, but this was not available in our darkroom. After drying, the plate is placed in a light-tight box in a refrigerator for the exposure time which may run into days if the concentration of the element is low. This low temperature prevents some decay of the latent image.

After exposure, the plate with the tissue in place on the emulsion is run through xylene to remove the paraffin and then an alcohol-water series to remove the xylene and alcohol. It is then developed for two minutes in D-19, passed through a stop bath and fixed. D-8 can be used to make the grains larger. After fixing and washing, it is run back through the alcohol-water series to xylene instead of drying in air. Air drying can be used, but the former method is faster and the tissue can be covered in balsam immediately.

When the slip is secure, the slide is ready for examination. At this point I wish to express my thanks to Mr. John Butterfield for permission to work in his laboratory with Mr. Joseph Magliozze who developed the instrument for Bausch and Lomb, and who taught me to use the phase microscope and worked with me in taking the photomicrographs.

Figure 3 shows on the right the phase photomicrograph of liver tissue. Several cells are in good focus and the nuclei are especially sharp. The intersection of the cross hairs indicates a structure at the center. This picture was taken just above the interface of the emulsion and the tissue. Without changing the field or objective, the phase plate in the condenser was removed and the microscope was focused just below the interface. The picture on the left shows the alpha tracks

by ordinary bright field illumination. This picture was taken at about $5/\mu$ below the picture on the right. It may be noted that only traces of the tissue can be seen. Thus, we can see through the unstained tissue without difficulty.

Figure 4 illustrates the advantage of bright field over phase illumination for looking through the tissue. This is a photomicrograph of the same level in the emulsion as in Figure 3, but photographed with the phase plate in the condenser. While the tracks can be seen if the photograph is examined carefully, they are obscured by the tissue which is also seen by the phase microscope. While ordinary bright field illumination is better than the phase method, we found that dark field illumination for the tracks is even better.

Figure 5 shows the same phase picture of the tissue on the right, and a dark field picture of the tracks on the left.

Before going on to the problem of registry of these two pictures for interpretive purposes, notice Figure 6. This is a photomicrograph of liver tissue stained with hematoxylin and eosin and photographed with ordinary monochromatic illumination. I do not wish to prove anything by comparing these two photomicrographs except that the phase microscope gives a picture for our purpose which is just as good as that of the stained section by ordinary illumination. Thus, the staining of the photographic emulsion is eliminated from the technique.

Since the two photomicrographs, the phase picture of the tissue and the dark field of alpha tracks were taken of the same field with variation only in depth of focus, the two can be superimposed for study. Figure 7 shows what was done with the help of three men at the Eastman Kodak Company, and I wish to express my appreciation to Dr. Loveland, Mr. Rudd, and Mr. John Swann for their advice and help in preparing this slide.

The negative of the tissue was printed on a medium contrast lantern slide and toned with sepia. The dark field negative was printed on another lantern slide. These two were then superimposed and brought into registry by use of the cross hair images. As you can see, this gives a good contrast, enabling one to study the location of the polonium atoms in the cells. You will remember that the tissue showed a structure at the intersection of the cross hairs. The superimposition shows a collection of alpha tracks at the same point. We conclude then that either in or near the structure there was a concentration of the polonium atoms. Furthermore, note that one or two tracks are only partly in focus. As this picture was taken at the top of the emulsion, the portion of the track in focus indicates the origin of the polonium atom, and, thus, it can be located in the cell.

It would be dangerous to draw any biochemical or physiological conclusions from this particular slide since it is the first one made and we

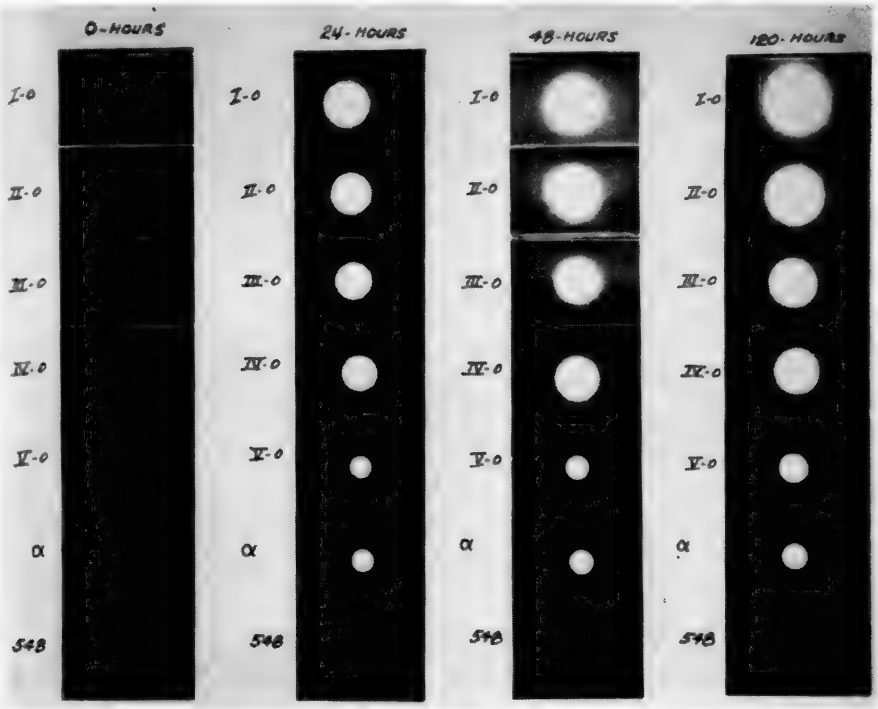

Figure 8. Images on different photographic plates produced by a constant geometrical and intensity source of radiorubidium. See text.

were more interested in the microscopic and photographic technique. However, we now expect to use this method for study of the distribution of alpha-emitting elements in the cell.

Up to this point alphagraphs or autographs produced by alpha particles have been discussed. As mentioned earlier, betagraphs must be considered separately as the beta particle behaves quite differently in the emulsion. It is to be remembered that we are interested in the beta-emitting elements since these are the ones that will give us information about basic and normal processes in the body.

Since the beta particle moves faster than the alpha and this greatly reduces the probability of hitting a small silver bromide grain, we had to consider emulsions with larger grains. We can use small grain plates and either increase the exposure time or the concentration of the beta particles. However, one always wishes to keep the exposure time to a minimum and many times it is desirable to hold the concentration down to prevent radiation damage. This, then, means that we must increase the probability of a hit on the grain by increasing its size.

A number of emulsion types have been used for betagraphs. Hamilton and Soley[5] at the University of California used an X-ray film.

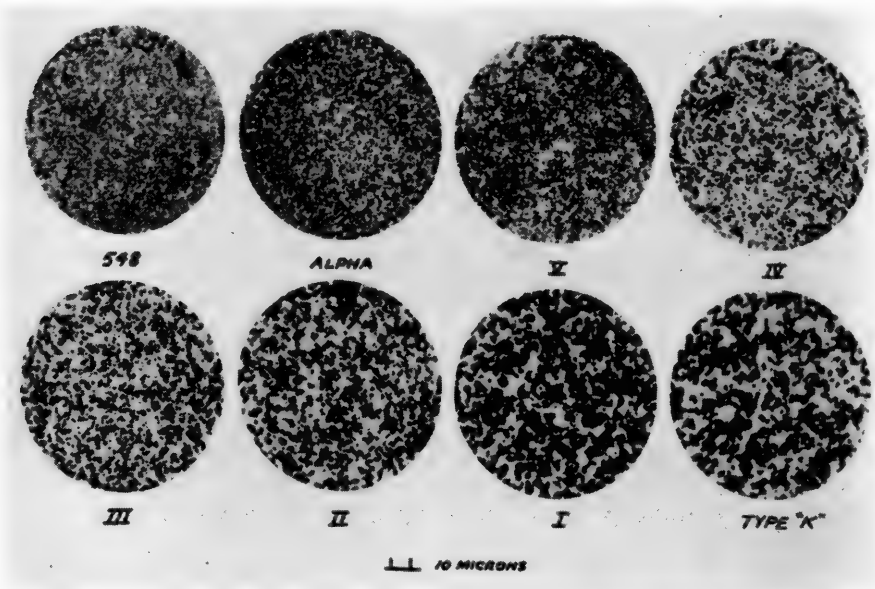

Figure 9. Photomicrograph of grains in photographic plate used for Fig. 8.

Because of the large grain size and consequent high background fog, this film is limited to gross comparison. For 10-25 X magnification this is satisfactory. Belanger and Leblond[6] and Evans[2,3] used Eastman medium contrast lantern slides. These have a grain size much smaller than the X-ray film but somewhat larger than the alpha plate grains.

For a preliminary insight into the relative sensitivity of various plates to beta particles, it was decided to expose a series of emulsion types to a beta-emitter. Figure 8 shows the results of exposing a series of five spectroscopic plates, the alpha plate, and No. 548 plate to radiorubidium. The source of radiation was made by soaking a fine filter paper in a solution of radioubidium, drying uniformly, and punching out disks of equal size. As this was only an exploratory experiment "to get the range", the activity of each disk was not accurately measured with the Geiger counter.

It will be noted that in any one time column, the diameter of the image increases as you progress from the No. 548 upward to the 1-0 spectrographic plate. This is also the order of increasing grain size. Also, for any one grain size the image diameter increases with time which means that the probability of hitting a grain increases with time. There are other factors influencing the speed of a plate, but I shall leave that problem to the emulsion research men.

Figure 9 gives a pictorial comparison of the grains of these plates. Also, included is the K X-ray film which is used frequently for gross

betagraphs. Just which plate to use for any particular purpose depends on the conditions. Obviously, the No. 548 alpha and V plate are too slow. The choice will depend upon the researcher and will for most purposes lie between the grain sizes of the IV and I spectrographic plate. The lantern slide is probably a good choice, but more work must be done on this problem.

The proper grain size is not the only factor in high betagraph resolution. If we could focus or collimate the beta rays, the problem would be easy. Morton[7] has focused the beta particles from monergic emitters to give a resolution of about $50/\mu$. This is very good except the elements in biology and medicine we are most interested in are not monergic. These elements have a spectrum of beta energies and focusing is not a simple matter. However, there are several methods under study at various institutions which we hope will solve the problem. To date, Leblond and co-workers at McGill and Evans at Columbia have made the best betagraphs.

Leblond's method is similar to the alphagraph method except that he places a drop of emulsion on the tissue section instead of placing the section on the emulsion. In this manner he can obtain a thin emulsion layer and thus improve the resolution. Evans places the tissue on the plate as Endicott and Yagoda and as we have done for alpha studies. Both Leblond and Evans stain the tissue and consequently the emulsion. Demers and Fredette[8] independently developed a method similar to Belanger and Leblond's for the study of radium in microbe cells.

At the University of Rochester we are starting similar work but plan to use the new thin emulsion proton plates now obtainable from the Eastman Kodak Company. With an emulsion of only $5/\mu$ thickness and mounting the tissue on the plate as in the case of the alphagraph and using the phase microscope technique, we hope to equal the resolution with less difficulty.

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Removal and Prevention of Fungus Stain of Photographic Negatives in the Tropics

Bowen S. Crandall †

SOON after my arrival at the Cooperative Experiment Station of Tingo Maria, the storage of developed photographic negatives became a problem. Tingo Maria is located in the Upper Amazon area of the Peruvian montanna, a region characterized by high rainfall and humidity. Within two or three months, negatives stored in open files, boxes or desk drawers became covered with fungus mycelium. This fungus growth is accompanied by a deep blue stain of the emulsion, making the negative unusable. Provisionally, the problem was solved by the use of dessicators and storage of the negatives over silica gel. This method is still satisfactory for 35 mm. film negatives since their small bulk allows them to be stored in cans which can subsequently be sealed to prevent excessive dessication after the proper moisture content has been reached. For large size negatives this method is unwieldy. Inquiry of photographers gave no satisfactory answer but did indicate that the problem was not unique to this region. No satisfactory solution was found in any available published articles on photography.

Facing the loss of virtually irreplaceable negatives, some solution had to be found. The problem is logically separated into two parts. First, the removal of stain from already damaged and unprintable negatives, and second, prevention of infection and staining in clean negatives or those which might subsequently be cleared of stain. The solutions to the two problems herein presented are known to be applicable only to the Tingo Maria region. I have no opportunity or present intention of trying them on a broader scale. They are presented

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with the thought that others may find that they will apply to their own regions or that similar methods or adaptations will suggest themselves.

There was an extensive collection of apparently useless, infected and stained negatives. A microscopic examination of stained areas in negatives showed the presence of fungus mycelium. Whether this fungus is of one or more species has not been determined. However, locally all stained negatives have the same appearance and have reacted uniformly to treatment. The fungus mycelium was present in the gelatin and occupying those areas containing few silver nitrate grains. The photographic image therefore appeared to be uninjured. A number of reagents which might be expected to have a fungicidal action or clearing effect on the stain were tried. Some negatives were lost before it was found that the most obvious of all chemical solutions, the standard photographic fixing bath or "hypo," both cleared the stain from the emulsion and apparently acted as a fungicide. A five to ten minute bath in hypo has cleared all negatives in the collection which were stained. A certain amount of the gelatin layer in which the fungus was present dissolves off and care must be used in washing the negative after this treatment or badly injured emulsions will wash off. However, once dried the negative makes contact prints and enlargements of a quality apparently equal to those made immediately after the original development and fixing. The fungicidal effect of the hypo has been demonstrated on negatives which after treatment were returned to a drawer in which some of the worst infection and stain occurred. The negatives remained free of infection for almost four months and then developed stained areas in previously uninvaded portions. No evidence of renewed growth of old infection was seen during the first three months of storage. It is not known whether the fungus mycelium was actually dissolved out by the Hypo or simply washed away with the gelatin in which it was growing or in some cases, being hyaline, is simply unnoticed in the emulsion.

The real solution to the problem is how to prevent infection and staining in the first place, not getting rid of it after it has occurred. The obvious method for reaching this objective is to impregnate the emulsion with some fungus inhibitor. Within recent years, a number of products of complex organic structure have been placed on the market for use in prevention of stain in lumber, seed treatment, prevention and control of damping off of seedlings, etc. Such of these as were available to the writer were tried as dips along with Mercury bichloride immediately following the washing of the negatives. Since it was undesirable to rewash the negatives to any extent after treatment, some proved undesirable because of discoloration or residue left in or on the

emulsion, and were discarded. Negatives after treatment were stored in a drawer in which heavy staining and infection had occurred. In the final tests, which have now been running for 10 months, one half of each negative was dipped and the other half left untreated to act as a check. Two solutions have been found which have thus far totally inhibited fungus growth and stain. In each case, the untreated half of the negative is now covered with fungus growth and stain. The two solutions which seem to show promise are 1 to 1,000 mercury bichloride and commercial Lignasan made up at the recommended rate of 2.4 gm. per liter. The mercury bichloride dip is objectionable due to slight discoloration of the emulsion, probably from the dye commonly added as a safeguard to the tablets sold for laboratory use. To date, no injurious effects have been observed on the Lignasan treated negatives and a Lignasan dip is now used on an experimental scale on the Pathology Department's negatives. There are doubtless many products available which, although designed for other purposes, will serve equally well for control of stain and fungus in negatives once they are found to be noninjurious to the negative itself.

This Department, while unable itself to do any investigational work on the problem, would welcome cooperation of workers who develop or adapt materials to inhibit fungus infection and stain and need tests under actual conditions to evaluate the efficacy of their treatments.

News from the Trade

Eastman's New Camera. A new 4 x 5 view camera was announced in August by the Eastman Kodak Company at the 56th Convention of the Photographers Association of America. Called the Kodak Master View Cameras 4 x 5, it is the first of a series of new postwar products planned by Kodak to reflect advanced thinking and meet the professional, industrial, and advanced amateur need for cameras and accessories which represent the best in design and utility.

Among the new features are a revolving back which may be used for picture taking not only in the horizontal and vertical positions, but at any point throughout a complete circle; a special ground glass release handle which relieves all tension on the ground glass and makes it possible to easily insert or remove film holders without jarring the camera; a standard monorail track 19 inches long, permitting a 15-inch bellows extension; a swing front as well as back; and spirit levels on both top and side of camera to assure perfect camera alignment.

In addition to such features, the camera incorporates all of the standard view camera adjustments in that both front and back are adjustable for horizontal and vertical swings, transverse or horizontal slide, and the camera has a rising-falling front. The camera is designed to use standard film or plate holders as well as film pack adapters.

To make the camera a completely flexible and utilitarian outfit, a full line of Kodak Ektar lenses are available in focal length from 4 inches (100 mm.) to 12 inches (304 mm.). These lenses are supplied either in Kodak Flash Supermatic or Ilex Acme Synchro Shutters. All lenses are Lumenized with Kodak's new hard coating for air-glass surfaces to reduce inner reflections and improve tone separation in the shadows. And each lens is tested for exact register of the images of the three primary colors. As a result, negatives and color transparencies made with these lenses can be expected to have superb sharpness and clarity.

The new camera's frame is of satin finished aluminum. It has bellows of gray leather, large easy-to-hold control knobs, and its design is such that it combines light weight with rigidity. A velour-lined gray carrying case is supplied with the camera. Space is provided in the case for 12 film holders, a film pack adapter, focusing cloth, extra lenses and accessories such as flashgun and reflector.

In announcing the Kodak Master View Camera 4 x 5, the company noted that while the professional film size has long been regarded as

8 x 10 inches, recent advancement in lenses, films, and other photographic equipment have tended to make smaller negative sizes practical. In this case, the 4 x 5 film size provides economical operation, yet the negative is large enough to be retouched and enlarged. The size also enables the photographer to give his client a wider selection of either color transparencies suitable for reproduction, or black-and-white proofs, without increasing his film expense.

Thus, the Kodak Master View Camera 4 x 5 brings to photographers added convenience in transporting equipment, in savings in film, and in small, more compact darkroom accessories.

Deliveries to dealers will begin the latter part of the year.

Kodak Flash Bantam f/4.5 Camera. Featuring built-in synchronization which guarantees positive flash synchronization with shutter speeds up to and including 1/100 of a second in Class "F" (such as FM) Lamps and 1/25 of a second only with Class "M" (such as No. 5 or similar) Midget lamps, the new model continues to embody many of the outstanding features which have made the Kodak Bantam f/4.5 a universal favorite.

Streamlined in design, the new camera offers a fine "pocket" size outfit which uses 8-exposure No. 828 Kodak Films, including full-color Kodachrome. The camera has a focusing range from 2½ feet to infinity, with fine Lumenized Anastigmat Special f/4.5 lens and a Kodak setting-type shutters with four speeds—1/25, 1/50, 1/100, and 1/200, plus "time" and "bulb" setting.

A field case, fashioned of suntan leather, similar to the cases for the Kodak 35, Kodak Reflex, is available for use with the Kodak Flash Bantam f/4.5 Camera. With the new field case, the Kodak Flashholder may be attached to the camera and the camera used for synchronized flash photography, without removing the camera from the case.

Deliveries on the new Kodak Flash Bantam f/4.5 camera are just beginning, and the Company stated that for some months there may not be sufficient stock to satisfy the demand. However, production is increasing and it is hoped that in the not-too-distant future production will be sufficient to meet the demand.

Association News

Business Meeting — 17th Annual Convention

The meeting was held in the Rundel Auditorium, Rochester, N. Y. on Wednesday afternoon, September 10th.

Reports: The *Treasurer,* Miss Zimmer, reported that receipts for the year totaled $4688.61, disbursements $4767.00, with $240.00 still remaining to be paid for secretarial expenses. The *Editor,* Mr. Massopust, stated in his report that our foreign subscribers now total 94 in 14 foreign countries. We have subscribers in every state except South Dakota. The *Motion Picture Committee* Chairman, Dr. Richards, reported that we are cooperating with the motion picture groups in other organizations, such as the American Society of Zoologists and the Society of American Bacteriologists. He spoke of the possibility that a national Biological Institute might be founded, in which case the compilation of a comprehensive list of films might be undertaken. All reports were accepted by unanimous vote.

Miss Gregersen, representing the Los Angeles Chapter; Mr. Lubin, representing Cleveland; Mr. Lindsay, representing Chicago; and Mr. Harding, representing Boston, all spoke briefly about the activities of their groups. The Boston Chapter meets three or four times a year; the others monthly. Ten members were present from the Chicago Chapter. Mr. McComb spoke on the part played by the Los Angeles Chapter in furnishing prints for the AMA exhibit. He announced that the Chicago Chapter will aid the Committee on Audio Visual Education of the American Academy of Orthopedic Surgeons to prepare an exhibit for the Academy's annual meeting.

Constitutional Amendments. Mr. McComb said the matter of increasing the dues had been studied by a committee, and that the Board had then discussed amending the Constitution. He thanked Mr. Varden for drawing up the amendments, which had been duly circulated among the members a month before the meeting. Four classes of individual membership and one class of non-individual membership are provided for in the amendment to Article III, Membership and Dues. The individual memberships are:

Active. Any person interested in the advancement of photography as applied to the biologic sciences shall be eligible for active membership.

Contributing. Any active or fellow member who wishes voluntarily to support the Association financially by paying any amount in excess of the normal active or fellow annual membership dues shall be a contributing member for that year. Upon meeting this requirement the

status of contributing membership shall become effective automatically. Such a member is under no obligation to retain contributing membership from year to year, and shall have the right to return to whatever previous membership status which applies without prejudice.

Fellow and *Honorary Fellow.* These two sections remain unchanged.

The non-individual membership is: *Sustaining Member.* Any non-commercial organization: e.g., trade association, scientific society, clinic, hospital, research foundation; or commercial firm: e.g., manufacturer, dealer, laboratory, is eligible for sustaining membership. Sustaining members are non-individual members and shall be listed in the membership roll under the name of the organization.

Mr. McComb then read the section on membership dues providing that the annual dues shall be determined by a majority vote of the Board and approved by a two-thirds vote of a membership quorum at any annual meeting of the Association. He said that the dues proposed for Active Members and Fellows for 1947-48 were $5.00; Foreign members $5.50. It was proposed that Journal subscribers should pay the same as members: $5.00. The annual dues for contributing members had not been fixed but would be any amount chosen by the member in excess of the active dues. The annual dues for Sustaining members would not be fixed, but would be determined by the majority vote of the Board of Directors at the time of application. He also read one or two minor changes in the articles on election of officers and the duties and privileges of members. (The Constitution will be printed in full in a later number of this Journal Volume). The motion that the amendments and dues be accepted as read was carried unanimously.

Second Meeting — Election of Officers

The elections were held on Friday evening, September 12th. The following officers were elected:

President—Dr. Edmond J. Farris
Vice-President—Dr. Oscar W. Richards
Secretary—Miss Anne Shiras
Treasurer—Miss Stella Zimmer
Directors: Until 1950—Dr. Jay M. Garner
Miss Avis Gregersen
Until 1949—Mr. Louis P. Flory
Mr. Albert Levin

1948 Convention. After a brief discussion the motion was made and carried that the 1948 Convention site be decided by the Board.

President-Elect. Mr. Massopust moved that the Association have a President-Elect. During the discussion that followed, the point was

made that such a motion could not be voted on as it entailed a constitutional amendment. Mr. Massopust substituted a motion that the Board of Directors be empowered to draw a contitutional amendment providing for presidential succession in office, to be placed before the Association. The motion was carried.

After a rising vote of thanks to Mr. McComb for his great services to the Association; and to the Rochester members for their hospitable welcome and efficient handling of the Convention, the meeting adjourned at 5:25 P.M. for the opening of the first International Exhibition of Biological Photography.

Respectfully submitted,
ANNE SHIRAS, *Secretary.*

NEWS ITEMS

An entry in the International Exhibition of Biological Photography was used as the cover for Science News Letter, October 11, 1947. It combined four pictures of a Black Widow Spider laying her eggs, photographed by Kenneth Middleham, Riverside, Calif.

Henry Lester, BPA, has worked with Dr. C. H. Curran, museum insect expert, to produce motion pictures—3,000 to a second—of a fly beating its wings. The fly's wings vibrate about 300 times per second and under the wings are visible two tiny balancers which stick out like a pair of hat-pins and go up as the wings come down. Their function evidently is to maintain the fly's sense of equilibrium just as the fluid in our inner ear maintains ours. They are like gyroscopes but they move through a ninety degree angle instead of going round. Their action was not known until revealed by the motion pictures. Several years of work have gone into a film which runs for only a few moments, but those few moments contribute valuable knowledge in several fields. Experts of the Sperry Gyroscope Co., at whose request the film was made, are studying it carefully. It is also being used by the Army and Navy. Dr. Curran calls the pictures "the most amazing ever taken of insects in motion."

Mr. E. K. Walrath of the Eastern States Farmers' Exchange (a farmers' cooperative purchasing association in West Springfield, Mass.), has been a member of the BPA for a number of years, and has made many color pictures in connection with his research in the action of fertilizers. He writes that he looks forward to a wider use of pictures, as the Farmers' Exchange now has a professional photographer on its staff. "There is a real need for illustrative material of nutrient deficiencies of plants if we are to secure the efficient use of chemical fertilizers. We find that we are not only concerned with nutrient deficiencies, but with

symptoms resulting from excessive applications of fertilizer. Now that techniques are being developed for the chemical testing of plants in the field, the value of photographic evidence will be even more helpful. The interrelations between the various nutrients must receive increasing attention, and some very interesting case histories could be shown."

The Photographic Society of America will circulate Medical Photographic Portfolios containing (1) clinical pictures, (2) pictures of gross specimens, (3) photomicrographs and/or macrophotographs. Transparencies may also be included (though they must be larger than 35mm.) Ralph Creer, FBPA, will be commentator; and another of our members, Don Loving, FPSA, will be Secretary. Mr. Loving's address, in case you wish further information, is 1309 North Pennsylvania Ave., Apt. 30, Indianapolis, Ind. Requirements for participation are that one be a member of the PSA and affiliated with the Pictorial Division, which is underwriting the cost of the activity.

Other than this project, Ralph Creer, who is head of the Chicago Film Council, has been busy reviewing entries for the "Films of the World Festival" which opened at the Surf Theatre, October 11th. Short documentary films produced by commercial companies or by amateurs could be submitted in either 16mm. or 35mm. One of the several categories under which films could be entered was the field of the biological sciences. One Saturday afternoon was devoted to each of the seven categories; the selected films being run off twice during the afternoon. Admission tickets were sold to the public at $3.90 for the series. Important and informative films were thus made available to a public that would otherwise have had no opportunity of seeing them. It is interesting that of the 11 films selected in the biological sciences, all were soundfilms. Seven were in black-&-white and 4 in color.

A company known as the Pittsburgh Scientific Art Glass Company has recently been formed in Tarentum, Pa., outside Pittsburgh. One of its activities will be the production of glass suitable for transparent backgrounds in scientific photography. Frank Heck, who recently joined the BPA and attended our 1947 Convention, writes—"You can inform the members of the BPA that this newly-formed company will try to solve their glass problems." Anyone with such problems, or who has suggestions to offer about the types of glass needed in biological photography can get in touch with this company by writing Mr. Frank H. Heck, Pittsburgh Scientific Art Glass Company, Box 262, Tarentum, Pa.

Mr. George L. Royer, FBPA, and Mrs. Royer spent the spring of 1947 in England, where Mr. Royer had been invited to demonstrate some of the work done at the Calco Chemical Division in the field of

dye application. Members who saw Mr. Royer's presentation of "Color Photography of Fluorescent Phenomena" at our 1946 Convention in Chicago will remember the fine series of comparative pictures he showed by using two projectors simultaneously. He employed the same system in England where, because of the scarcity of projection equipment and the difference in electrical power, he had to carry two projectors and sets of resistances wherever he went. He says that he was "more or less of a traveling circus" but that color pictures were well received since little color is being used in microscopical field in England these days.

Mr. Joseph Haulenbeek, who for a number of years has been head of the Illustration Division of the Rockfeller Institute for Medical Research, New York City, is now at the Lederle Laboratories of the American Cyanamid Co., Pearl River, N. Y., where he has organized a new Photographic Division.

Warren Sturgis, BPA, has joined the Dwinell Grant Productions, New York City, as head of the Medical and Technical Section. This firm, recently organized, will make educational motion pictures and slide-films, assisting in the preliminary planning and undertaking the complete production.

Rowland Schnick, BPA, who served with the First Medical Museum and Art Detachment in India, is now in charge of the Medical Illustration Laboratory of the Veterans' Administration Hospital, McKinney, Texas. The Illustration Laboratory has its own building consisting of fifteen rooms and will offer a wide range of services in medical art and photography.

Dr. Paul Holinger of Chicago has been named winner of the grand prize in the scientific film section at the World's Film and Fine Arts Festival conducted at Brussels, Belgium. Dr. Holinger and Dr. Ralph G. Rigby submitted "Bronchial Tumors" a kodachrome movie taken through a bronchoscope. Dr. Holinger is a member of the BPA, and an excellent film of his on "Organic Disorders of the Larynx" was presented at our 1947 Convention.

1947 Convention

We had 161 registrations at the 1947 meeting. This tops our previous record achieved in Chicago in 1946 by 19. The Convention Committee planned a good program and ran it on schedule. In 3½ days we heard 26 papers, took 2 trips and had 3 motion-picture sessions, each one on time almost to the minute. Our members stayed consistently on the job. Although it was hot, the sessions, the trips and the official meals were all well attended. The meeting facilities were excellent. Both the Rundel auditorium and gallery were well suited to our needs, and the personnel

were most cooperative. Careful planning was also in evidence during the session at the Rochester General Hospital. Students of the Hospital's School of Photography ushered the guests to the auditorium, where an interesting program was excellently conducted.

Two New Fellows of the BPA. Announcement was made at the annual banquet of the election of John J. Beiter of the Rochester General Hospital, N. Y. and Henry Louis Gibson, Eastman Kodak Co., Rochester, N. Y. as Fellows of the BPA. John Beiter's contributions have been in the field of medical photography; H. Lou Gibson's in the fields of medical and natural history photography. Both are well known to most of our membership.

Impromptu Motion-Picture Symposium. The motion-picture sessions were interesting and well-attended, but the number of films scheduled left no time for discussion. It became evident that several of the members were deeply interested in motion-picture production and wanted a chance to exchange ideas. An impromptu symposium was announced for Friday afternoon Sept. 12th. Although it conflicted with the trip to Kodak Park, a number of members attended and found the conference so worth-while it will probably become an annual institution.

International Exhibition of Biological Photography. This exhibition was of course one of the main features of the Convention. It was well hung, in the attractive Rundel gallery. Although the natural history and biological subjects were separated from the unmistakably medical pictures, the fact that all the subjects were of living forms, or forms that had once lived, gave cohesiveness to the whole. As always, the glowing brilliance of the color transparencies stole the show. But the black and white prints were quite as rewarding, in their less spectacular way. There were only a dozen or so of color prints but these were of high quality.

Participation in the exhibition was open to biological photographers everywhere, but actually the only entries from outside the U. S. came from Canada and England. It is to be hoped that as post-war photography gathers momentum overseas, and the difficulties of transportation become less, a truly international Salon can be held. This one was a good beginning and set a high standard.

Of the nearly 200 prints, about 60 have been retained to become the Association's 1947 Travelling Salon. It will be shown as a section of the International Science Exhibition of the American Association for the Advancement of Science in Chicago from December 26 to 31. After that it will be available to BPA members for exhibit at chapter meetings, scientific meetings and scientific institutions.

Notice to Our Members in Photographic Businesses or Who Do Free-Lance Work

From time to time scientists write asking where they can have photographic work done in certain sections of the country. We send them the names of biological photographers we have listed as doing free-lance work or conducting photographic businesses in the region named, or near-by. It is probable our lists are not complete and we would like to make them so.

If you are prepared to accept orders for scientific photography will you please send me your name and address and information about the types of photography you do? Sometimes the scientists want help in setting up for certain types of routine records in their offices or laboratories. Let me know if you wish to do any consulting work of this kind. Also let me know whether you give any courses in biological photography, either general or specialized. We have inquiries about general courses; and also about specialized courses for technicians who would be making photographs in only a limited field.

ANNE SHIRAS, *Secretary*
University Office
Magee Hospital
Pittsburgh 13, Pa.

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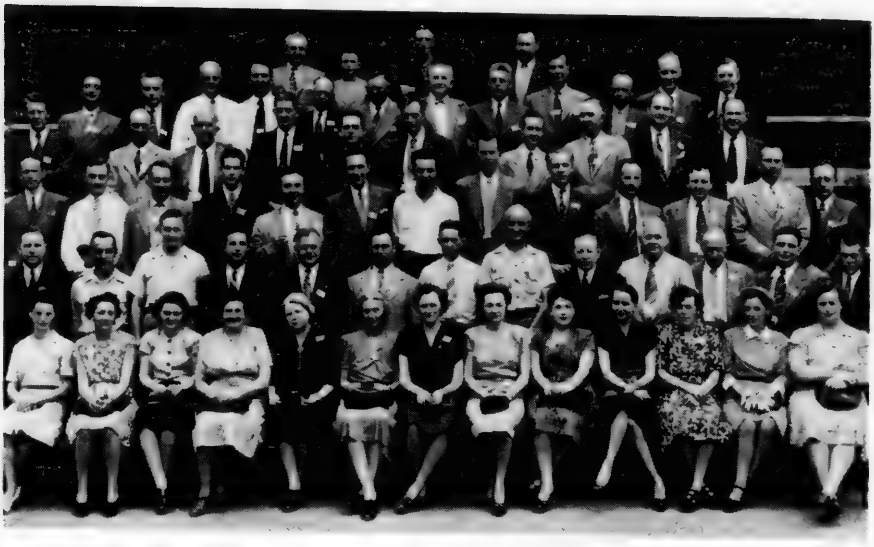
Chicago	Maria Elsasser Ikenberg 832 Gunnison Street Chicago, Illinois
Cleveland	Fred S. Beal St. Luke's Hospital Cleveland 4, Ohio
Los Angeles	Avis Gregersen Department of Dermatology Southern California School of Medicine Los Angeles, Calif.



1947 B P A Convention

Rochester, New York

Contributing Members

Any active or fellow member who wishes voluntarily to support the Association financially by paying any amount in excess of the normal active or fellow annual membership dues shall be a contributing member for that year.

The BPA thanks the following members for joining or renewing in the contributing group:

Baldwin, Dr. Glidden S.
139 Vermillion Street
Danville, Illinois

Bell, Dr. Dennistoun M.
"Broadview"
Amagansett, N.Y.

Brubaker, J. D.
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Evanston, Ill.

Dr. Tibor Benedek
25 E. Washington Street
Chicago 2, Illinois

Cammon, W. A. "Don"
Cameron Surgical Specialty Co.
666 West Division Street
Chicago 10, Ill.

Creer, Ralph P.
American Medical Association
535 N. Dearborn Street
Chicago 10, Illinois

Dr. E. J. Farris
The Wistar Institute
Philadelphia 4, Pa.

Flory, Louis Paul
Boyce Thompson Institute
for Plant Research
Yonkers 3, N.Y.

Footer, Dr. A. Wilson
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Oakland 11, California

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Dr. Jay M. Garner
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Winnetka, Illinois

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Joseph T. Jackson
Emory University Hospital
Emory University, Ga.

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Waterbury, Conn.

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Miess, Ray
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Milwaukee 2, Wis.

Perskie, Leonard
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New York 11, N.Y.

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Harper Hospital
Detroit 1, Mich.

Albert Sadler
Wayne County General Hospital
Eloise, Mich.

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Riverdale 63, N. Y.

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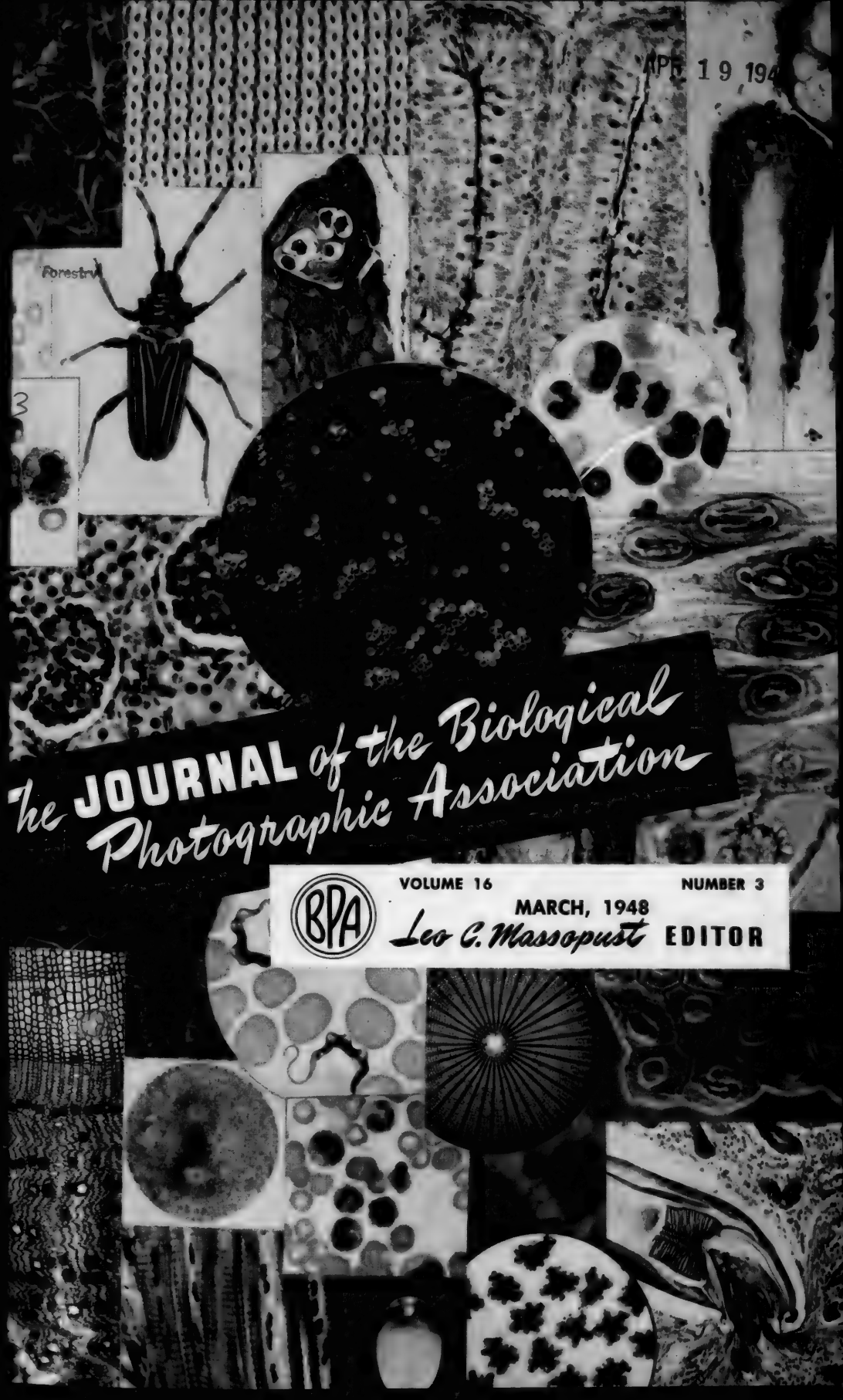
Committee on Fellowships	Dr. Arthur W. Proetz 12 Westmoreland Place St. Louis 8, Missouri
Committee on Grants	C. Graham Eddy Veterans Administration Washington 25, D.C.

Discussion of Dr. Sutton's Paper

In the discussion which followed the presentation of Dr. Sutton's paper given at the BPA Convention, two or three members reported that although their departments had earlier been under the direction of some members of the medical staff, they had found that the work done for the Medical Director's department had been out of proportion to the work done for other departments of the hospital or medical school; therefore it seemed better if photography were not under the direction of any one man or department.

Dr. Bohrod said that the discussion was revolving too much around the question of power, and not enough around the question of how a department really functions best. He said having a medical director usually proved advantageous; but if the right man or the right method were not found at the beginning some other solution should be tried. Some day, he said, he would like to talk to us about the difference between a good photograph of a medical subject and a good medical photograph. They are not the same; and medical direction produces the latter. A good director, one who is sincerely interested in photography, will not preempt the services of the photographer for his own department's work. If he does, he is interested in himself, not in medical photography, and is not a good director. If there is no one in an institution who is there long enough each day and who is truly interested in the subject, then of course it would be better to let the medical photographer alone. But if a man can be found, no matter whether he is the assistant director of the hospital, the pathologist, the radiologist, or whoever, who is truly interested in photography and knows some of the problem, then the medical director and a good medical photographer working together produce the best results. Any system that produces results in a given institution is the proper system. Dr. Bohrod saw no reason why every hospital should have the same mechanism for achieving these results. The important thing is to keep the aims uppermost and not get involved in questions of power.



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MARCH, 1948
Leo C. Massopust EDITOR

1948 Convention

September 8-10, 1948
University of Pennsylvania
Philadelphia, Pa.

Convention Chairman

Harry E. Morton
School of Medicine
Univ. of Penna.
Phila. 4, Pa.

Program

Harold C. Baitz
The Wistar Institute
Phila. 4, Pa.

Exhibits and Salon

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Basil B. Varian
School of Medicine
Univ. of Penna.
Phil. 4, Pa.

Commercial

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Temple Hospital
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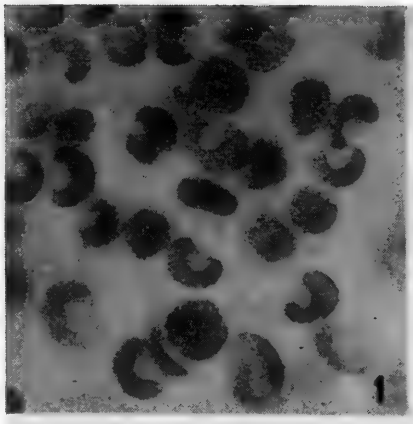
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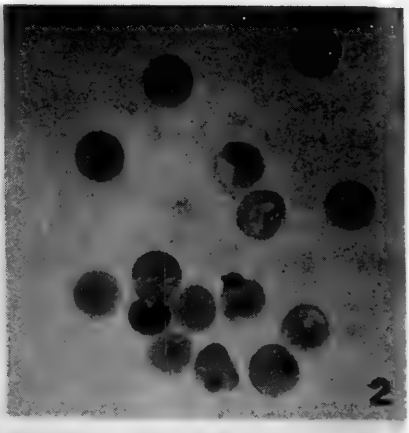
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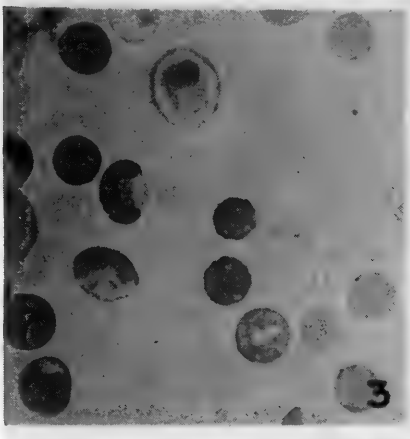
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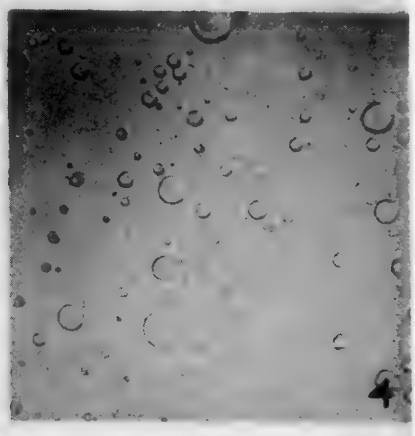
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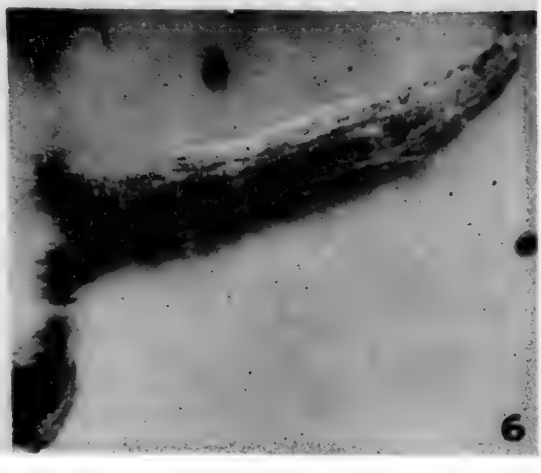
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Photomicrography Of Moving Objects By Electronic Photoflash Technique

Stewart H. Webster, Ph.D., Ervin J. Liljegren and David J. Zimmer

SEVERAL years ago work was started in this laboratory on supravital examination of blood. Wet preparations, using a slide and coverslip, were used since the structure of the cells could be seen much more clearly as they were floating and recognition and counts of inclusion bodies within the cells could be made more rapidly and easily in this way. The freshly shed blood was ordinarily mixed with a drop of Locke's solution whose composition was modified by the addition of water to meet the particular requirements of the species used. At times staining was employed in order to differentiate the cell structure and to increase contrast. For visual observation at 1350 X magnification the customary rolling and movement of the cells were not objectionable. For photomicrographic purposes, however, this movement introduced a difficult problem since it necessitated cutting down the exposure time which in turn required a corresponding increase in illumination. The use of film of high speed was objectionable since contrast would then be sacrificed.

In the search for a source of light of greater intensity than that provided by the ribbon filament lamp it was found that the method of Carlile[1], using a Mazda SM photoflash lamp, would provide sufficient light for magnifications up to and including 660 X (high dry) but beyond this sufficient illumination was lacking even when Ortho-X-film

1. Normal guinea pig erythrocytes. 1350 X.
2. Heinz bodies in erythrocytes of mouse following administration of sulfanilamide. 1350 X.
3. Spherocytes and "spine cells" in blood of guinea pig following exposure to stibine, a hemolytic agent. 1350 X.
4. Whole Milk. 660 X.
5. Portion of a naid. 100 X.
6. Rotifer, showing cilia. 150 X. (Enlarged to 300 X.)

Received for publication December 29, 1947, from the Laboratory of Physical Biology, National Institute of Health, Bethesda, Md.

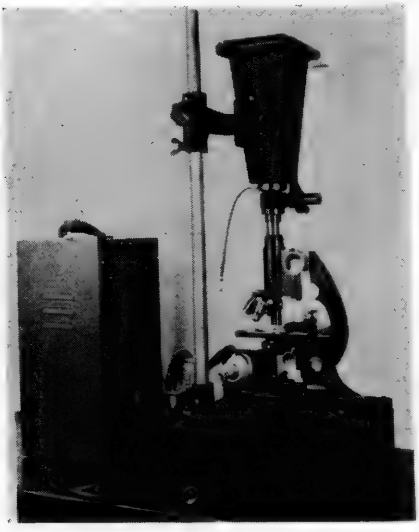

Figure 1. Electronic flash apparatus.

was used. According to Mohler[2] the SM lamp has an average peak value of 500,000 lumens, while the No. 5 photoflash lamp averages around 1,200,000 lumens. However, it was found that the higher illumination of the latter type was not as satisfactory as the SM lamp in stopping motion.

In order to secure high speed pictures, use was made of the electronic flash apparatus shown in figure 1. This was constructed essentially after the plan of Dezettel[3] and utilized a type 54R4X Amglo electronic flash lamp as the source of light.

The peak lumen rating of this flash tube at 2500 volts D.C. was stated by the manufacturer to be approximately 50 million lumens. Since the voltage used by us is about 2000 volts D.C., the illumination is somewhat less. With a condenser capacity of 24 microfarads the flash produced lasts for about 120 microseconds (approximately 1/10,000 sec.). The color temperature is approximately 6500° K., which makes it suitable for use with daylight color film.

For protection against contact with the 2000 volt circuit the entire apparatus with the exception of the lamp and firing button was enclosed in the metal box, as shown. The off-on switch can be seen as well as the two signal lights for indicating when the current is on and when the lamp is ready to fire. The flash lamp is connected to front panel jacks by short cables and a reflector serves to concentrate light on the first-surfaced microscope mirror about 5 inches away. In between the two and arranged so as to be removable during the flash can be seen the automobile headlight bulb operating from a transformer on 6 volts through a rheostat. The filament of this lamp is so arranged as to be at the same height above the bench as the centers of the mirror and the flash lamp, all three having a common optical axis. This auxiliary source of light permits focusing of the object on the slide and adjustment of mirror and condenser. The latter is manipulated so as to bring the image of the headlight filament in focus together with the image of the object. The iris diaphragm is ordinarily used at full

aperture although at low magnifications the opening can be decreased if it is desired to reduce the illumination from the flash lamp. Increase in object contrast at high magnifications through reducing the iris opening is not advisible due to great loss of light produced in this manner.

When ready to photograph the object, the switch is closed on the photoflash panel and about half a minute is allowed for the condensers to become charged, the neon signal light indicating this condition. Since no synchronization device is used on the camera shutter, the open flash technique is used. Shortly before exposure the film slide is opened, the shutter being closed. After a final observation of the image in the telescope the headlight bulb is withdrawn, the shutter opened and the flash lamp is fired.

The six illustrations show the application of this technique to moving objects which are ordinarily difficult to photograph. These were all wet preparations mounted between a slide and coverslip. The small fat particles of milk (Plate I, figure 4), for example, exhibited marked Brownian movement. Likewise, the moving cilia of the retractile disks of the Rotifer (Plate I, figure 6) appeared like windmills to the eye.

All photomicrographs were made with a Bausch and Lomb type K (vertical) camera, using 3¼" x 4¼" sheet film. At the lower magnifications (100-150 X; Plate I, figures 5 and 6) sufficient light was present to permit the use of the slow Kodak Contrast Process Ortho film having a Weston (daylight) speed rating of 16. At higher magnifications (Plate I, figures 1-4), however, a faster emulsion was required and Defender X-F Ortho film, with a Weston (daylight) speed rating of 50, was used. Films of intermediate speed, such as Panatomic-X with a Weston (daylight) rating of 32, were found to give very faint images at 1350 X magnification. Printing quality of such films can be markedly improved by a second exposure comparable to the first, except that a slide and coverslip with water in between is substituted for the wet preparation. In this way the background is darkened somewhat, making it easier to print. Since all the negatives taken at magnifications higher than 150 X are somewhat thin, No. 5 Velox paper is generally used to increase contrast in the prints.

Certain limitations in the application of this apparatus were discovered. For example, in attempting to photograph fat particles in homogenized milk the globules were so numerous and small that focusing on particles at one level resulted in poor contrast and hence poor definition. Bacteria also proved to be difficult subjects since their extremely small size required high magnification. At 1350 X magnification, with a 2.0 mm. objective, the depth of field was less than ¼

micron[4] and even at 100 power, with a 16 mm. objective, the field depth amounted to less than 9 microns. Therefore, the difficulty of photographing small moving objects under these conditions arises from the necessity of focusing for a certain level and then exposing the film when the subject appears in that plane. Bringing the slide and coverslip closer together will somewhat restrict but will not altogether prevent movement in a vertical plane. On the other hand, lateral motion can be easily arrested since the flash persists for only about 0.0001 second.

Besides the optical limitations just mentioned there is another limitation which depends on the failure of the emulsion to obey the reciprocity law[5]. This factor becomes of greater importance at low intensities of illumination and with slower film. It is possible that an apparent increase in emulsion speed can be affected by hypersensitization.

Heretofore high speed electronic flash lamps have been largely used for analysis of rapid motion[6] but more recently they have served as a substitute for flash bulbs in general photography. It is possible that certain time lapse photomicrographs which utilize elaborate motion picture equipment can be taken with the apparatus described in this paper. As the cost of the electronic flash units becomes less it is expected that their applications to the field of biological photography will be greatly extended.

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A Method of Preparing Medical Motion Pictures

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MEDICAL motion pictures were made successfully as early as 1892, but the beginning of modern medical cinematography was marked by the introduction of 16 mm. film in 1923, followed in 1935 by the production of color film by the Eastman Kodak Company. Much of the present day excellence of medical motion pictures can be attributed to the perfecting of the 16 mm. camera. For comprehensive discussion of the subject, the reader is referred to the writing of Burke[1], Julin[2], Richards[3], Sarnoff[4], Tuttle[5], and others.

This paper deals with one of the techniques employed in the preparation of 16 mm. colored film in the Army Medical Department, with special emphasis on motion pictures of surgical operations. Its purpose is to outline a method which in my experience has proved most satisfactory and to show that by proper planning and systematic production the medical motion picture can be a most effective supplement to medical instruction.

Of the photographic visual aids which include prints, exhibits, slides, film strips, and silent and sound motion pictures, the last mentioned has perhaps the greatest possibilities and widest application. At present it is merely a supplement to existing methods of teaching, but it is probable that in the near future the suitably prepared motion picture may well replace other educational procedures. It is hoped that some of the problems of present day progressive medical education will be partially solved by the instructional film.

During the war, motion pictures played an important role in the training of all service personnel. Of particular interest to medical officers and enlisted technicians were the films of new clinical procedures and advanced surgical techniques. Illustrative material on diseases peculiar to foreign countries and emergency surgical procedures in combat zones was successfully recorded in motion pictures.

The Army Medical Illustration Service is the clearing house for medical films which have been and are being produced by the War Department. Most of these films are available on a loan basis to any

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medical museum, medical school, or scientific institution as aids to teaching and research. The program of the Army Medical Illustration Service is coordinated with the activities of the recently organized Interdepartmental Committee on Medical Training Aids, which is composed of representatives of the War Department, the Navy Department, the Veterans Administration, and the United States Public Health Service. Its ultimate aim, in cooperation with the Committee on Audio-Visual Aids and the Association of American Medical Colleges, is the establishment of a Medical Film Institute.[6] The primary functions of the organization will be to conduct medical film research, to provide advisory service, and to catalog and disseminate information essential to the production of effective medical motion pictures for use in training and research. Such a correlated project should effect a pooling of resources and prevent a duplication of effort.

The medical photographer, in addition to possessing a broad knowledge of the various phases of photography, should have a general understanding or working knowledge of anatomy, medical terminology, microscopic practice, and surgical procedure. He is often called upon to exercise his ingenuity and resourcefulness in difficult situations. Although equipment may be of the highest quality, the end result is achieved essentially by its user. Thorough familiarity with his equipment will enable him to direct primary attention to the photography and to meeting unpredictable emergencies. He must be prepared to act not only as cameraman, but also as lighting expert, scenario writer, editor, and director of a film. Continuous experimentation and research are prerequisites in surmounting the many obstacles which may confront the medical photographer. At times it may be necessary for him to design and construct special equipment to meet needs which are not forseen and provided for by the manufacturer. If he is to work under the most favorable circumstances he must gain the confidence of the surgeon, cooperate with the various technicians, and maintain an agreeable but impersonal attitude toward the patient. Inasmuch as his function is to present a story or idea graphically, his pictures must possess extreme sharpness, good composition, correct exposure, and proper sequence. These essentials make it necessary that the medical photographer be a well-trained, versatile individual, whose interest in his work is paramount.

Assuming that the subject or topic for filming has been decided upon, either by a carefully selected planning board or by a contributing consultant, the preparation for photography would follow immediately. To begin with, the contents of the film should be in accord with its use. The content requirements of the film for the advanced specialist are

Figure 1. Flexible extension lamps attached to Professional Jr. tripod.

usually precise and confined to the important aspects of the immediate subject; whereas the film prepared for instructing the medical student should contain all fundamental and basic steps in detail.

The excellence of the finished film depends to a large degree on the cooperation between the surgeon and other persons concerned in the operation, and the photographer. A great number of physicians are good photographers and credit must be given to those who have done and are doing excellent work in the field. Many of these men, however, lack not only the time but also the thorough understanding of photographic processes and problems to be met which are acquired by the skilled photographer only after years of training and practical experience. Surgeons who possess some knowledge of photography can be most helpful to the photographer in producing a superior film. The surgeon who is applying photography to his work for the first time must be thoroughly oriented before an attempt at shooting is made. He, and if possible his operating team, should be acquainted with the following requisites: awareness of the camera at all times, and the need for definite and illustrative actions. Frequent cleansing of gloves, changing of drapes, and sponging of the wound will add to the quality of the film, if these

details can be attended to without detriment to the patient. Usually, the surgeon, engrossed in the project, is most cooperative and, as a result of the orientation will overcome the shyness he often feels in working before the camera for the first time.

Even though the photographer has had previous experience in filming surgical procedures, he must familiarize himself beforehand with the type of operation to be performed, time required, anesthetic used, size and location of incision, position of the patient, and with any other factors which might later lessen confusion and waste of film and time. If he is unable to interview the surgeon, he must obtain information from others familiar with the operation or from the books on surgical technique. The ideal situation is, of course, for him to observe in advance operations similar to the one to be photographed, making mental or written notes of pertinent details.

The next important step is the preparation of the scenario and shooting schedule. The latter is mainly for the use of the cameraman. A clear conception of the purpose and possibilities of the finished film will reduce the waste of time and effort to a minimum. All scenes, both tentative and definite, should be noted. They should include preoperative, and post-operative aspects of the patient; views of radiographs, photomicrographs, specimens, charts, and any other details which contribute to an understanding of the subject should have a place in the film. Deviation from the scenario and shooting schedule may be caused by later additions or changes and by unexpected turns which the operation may take, hence both photographer and surgeon must be ready to cope with unexpected situations. The services of a medical stenographer during the operation assures a more accurate record of the proceedings, since the narration is most often based on the working scenario and the surgeon's dictation at the time of the operation.

Simple but adequate equipment planned for portability is necessary for the space limitations of the average operating room and for the camerman who must prepare films in different locations.

Before describing the equipment, I wish to emphasize that mention of specific articles by trade names in this paper by no means implies an endorsement of any of them by the Army Medical Department. They are simply the equipment and supplies that I have found effective in my work.

The Cine-Kodak Special 16 mm. camera with its convenient, interchangeable film magazines, direct reflex viewer, double lens turret, and arrangements for "fades" and "dissolves" was found to be very adaptable to the filming of medical subjects. From the large selection of Cine-lenses, the three most often utilized are the one-inch F/1.9 for establishing and long shots, the 2½ and F/2.7 for medium and some close-ups, and the 4-inch F/2.7 for the extreme close-up. The 2½ inch

lens is most frequently used throughout the operation as it will record close-up views of significant actions without sacrificing the proper anatomic relationships.

The tripod and lighting equipment are combined into one unit similar to that described by Burke. The arrangement shown in figure 1 permits rigid support and adequate elevation for the camera and lighting units and is especially adaptable to surgical photography. The tripod, a Professional Jr., is manufactured by the Camera Equipment Company of New York and has the usual panning and tilting head. The lighting units, called "Floating Fixtures", are made by the Dazor Manufacturing Company of St. Louis. Modification of these fixtures to increase the tension of the extension spring permits the use of a larger reflector with a No. 2 photoflood.

Lighting units are attached near the top of the tripod, but they can easily be detached and adapted to the ordinary Victor collapsible light stand for illuminating longer shots (figure 2). The photographer controls the lights by means of a high-low switch located near the base of the camera. Sufficient illumination for the use of the surgeon is supplied at low intensity, and during actual shooting the intensity is increased to high. In this way there is little danger of excessive heat to the tissues or discomfort to the patient. Most superficial operations can be adequately illuminated by the use of two No. 2 photofloods arranged as illustrated in figure 1.

When deep cavities are encountered, the 750 watt Bardwell McAllister Focusing Spotlite is used with a GE-CP-T-24 lamp for illumination. The combination of this lamp rated at 3350° Kelvin and the No. 2 photoflood at 3400° Kelvin seem to give the best results for use with Type A Kodachrome. A handle is attached to the spotlight unit, thus preventing possible burns during manipulation by the photographer (figure 3).

The arrangement of the lighting equipment for rapid repositioning, described in the preceding paragraphs, is planned to achieve the best possible photographic results with the least obstruction to the course of the operation.

Although crudely constructed, the kit attached to the rear leg of the tripod (see figure 1) provides immediate access to the exposure meter, a roll of film and an assortment of necessary lenses.

An arrangement for the photography of abdominal and spinal operations or those in situations requiring perpendicular shooting is illustrated in figure 4. To prevent a double image, an outside or front surfaced mirror, 10 x 12 inches, is attached to the Dazor flexible arm. The photographer can readily adjust it to the proper angle over the field of operation by means of a rod extending from the mirror to the tripod. Naturally, the reflected image is reversed. To overcome this

Figure 2. Use of collapsible light stands with flexible extension lamps.

the camera is fixed upward and a prism mounted on its lens corrects the image for projection. This arrangement is simple but effective in operation, extremely portable, and eliminates any need for cumbersome booms, catwalks, or false ceilings.

To prevent collapsing of the tripod and to increase its mobility, the tripod truck shown in figure 5 is patterned after the Eastman Cine-truck. Because of the additional weight and pull of the lamps it

was necessary to use 1½ inch piping in its construction. The rear leg is locked in place to prevent possible tipping of the tripod and lights, and the rear wheel, which turns in any direction, can be steadied by means of a slotted, padded block of wood.

The multiple outlet box is constructed to prevent overloading of existing electrical outlets, which are usually loaded to capacity with operating room equipment. The cable stored around the reel is 100 feet in length and can be attached to a nearby fuse box by means of the two insulated clamps, or it can be adapted to standard wall outlets (figure 5). It is advisable to have two or three extra extension cords on hand in case of need. A precaution against the danger of explosive anesthetics is the use of explosion-proof switches, twist lock plugs, and the taping of all other electrical connections.

Any substantial stool or bench of the proper height is suitable for supporting the cameraman.

Additional equipment and materials include a screwdriver, pliers, pocket knife, and scotch tape for use in emergency repairs. Ample supplies of film and lamps are essential.

Kodachrome safety film 16 mm., type A, is used exclusively, as under proper lighting conditions and with correct exposures it best provides the realistic color renditioning of tissues, making immediate differentiation between anatomic areas possible. Care should be given to secure even and flat illumination, because there is usually an increase in contrast during the process of duplication. When numerous copies are required, certain authorities consider it advisable to use the 16 mm. Kodachrome Commercial film which, although it cannot be projected in its original form, results in excellent duplicates.

Desirable conveniences, although not absolute essentials for good results, are the 200 foot Cine-chamber which eliminates frequent reloading, the Cine-motor drive which makes continuous shooting possible, the gyrotype tripod head which facilitates smooth panning and tilting, and air-cooled illumination which prevents possible discomfort to the patient.

Illustrated in figure 5 is the combined arrangement set up for the motion picture in the operating room. Equipment with these features and safety precautions overcomes some of the problems encountered in surgical photography and adds to the well-being of the patient.

Consideration for the patient and his part in the movie should be observed by obtaining his agreement to being photographed. It is advisable to have him sign a written statement to the effect that he will not make any claim against the surgeon, the photographer, or the institution. Similar releases should be obtained from the other prin-

Figure 3. Spotlight with focusing snout for deep cavity illumination. Handle prevents burns during manipulation.

cipals involved in the movie. This practice is now in effect in the Army Medical Department.

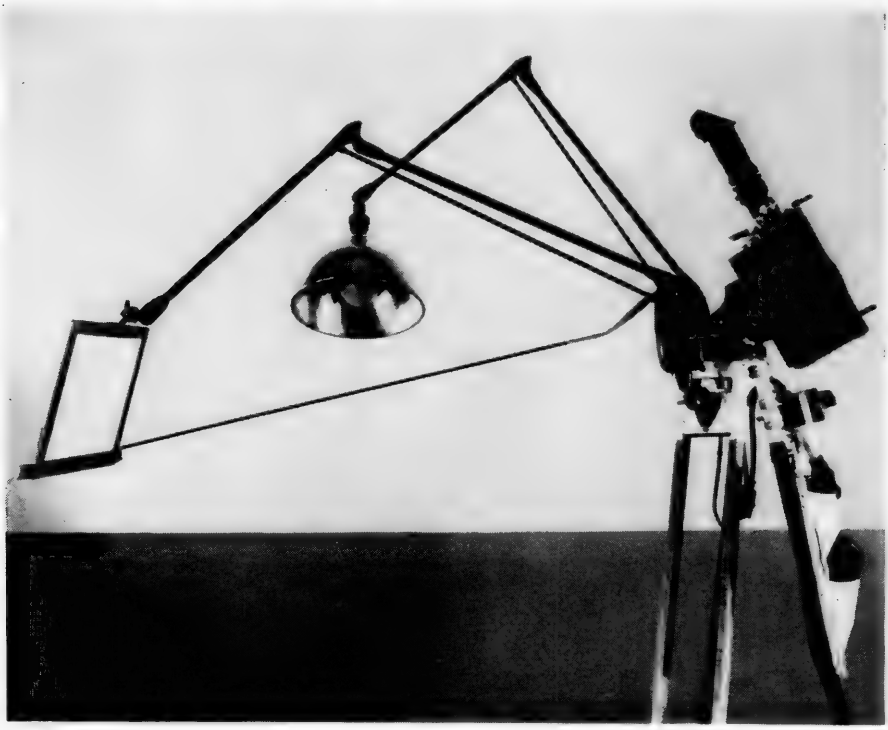
Although most hospitals and medical institutions prepare medical motion pictures, there is a wide divergence in methods used by various photographers. For this reason, when the photographer is working in a new location, he should orient the personnel involved, as familiarity with photographic procedure insures cooperation. Many films have been classified as "good" which would have been "excellent", had there been full cooperation.

In an operating room where color photography is to be done it is essential that all existing illumination, whether daylight or tungsten, be excluded since the correct illumination for indoor Kodachrome will be supplied by the proper lighting equipment. Information concerning the locations of all existing outlets and the amount of wattage which each will supply, combined with a knowledge of the arrangement of the various pieces of surgical equipment, makes it possible for the photographer to place his camera and lighting equipment most advantageously. It is believed that colored drapes, if available and if all of the

same hue, will give the best results for photography. When deeper cavities and darker tissues necessitate an increase in exposure, colored drapes do not over-expose as easily as does white sheeting.

The preparation of supplementary scenes, which are usually photographed in the ward or studio, does not present as great a problem as do the operating room sequences. The bed patient can usually be transferred to a litter and here, too, the use of colored sheeting is suggested. Adequate illumination of the background, which should be unobstructed and of a pleasing color, as well as of the subject, is essential to good color photography. Rehearsals of the action aid the patient in overcoming camera shyness and reduce the number of photographic errors. It is sometimes necessary to have the surgeon or an attendant point out the salient details and assist the subject with the required motions. If a number of patients present the same condition in various stages of development and treatment, scenes of progress can be made simultaneously, eliminating the delay incurred in the taking of "follow-up" shots of all stages in one patient. The nature of many diseases, however, demands that the same individual be used for such progressive scenes.

Figure 4. Front surfaced mirror on extension arm and prism mounted on camera lens for perpendicular surgical photography.



Actual photographing of the operation is naturally the critical episode in the production of the movie and the one to which all other activities are secondary to a greater or less degree. The photographer and his assistant when working in the operating room must abide by the rules of asepsis by wiping all equipment, draping the tripod and light stands with sterile sheets, and donning the usual surgical gowns. These precautions, essential to the well-being of the patient, also enable the photographer to work close to the surgical field without danger of contamination, so that with long focal length lenses he may obtain extreme close-ups.

Prior to preparation of the patient, the photographic equipment should be adjusted, then short scenes of any special surgical equipment, the induction of anesthesia, the administration of intravenous injections, and positioning of the patient should be taken, since each of these steps is significant in the pictorial record of the operation as a whole.

The first scene of the surgical procedure itself should establish the location of the incision in relation to the body, and all subsequent scenes should be photographed with smooth continuity and in such a manner that the observer has a clear picture of the relation of the action to anatomic structure. All changes in camera position during the progress of the operation should be explained in the final narration. In some operations two cameras must be used to record simultaneous actions, as for instance in neurosurgical procedures when incision into the central nervous system causes reflex action of an extremity. But in most operations ample coverage can be obtained by an experienced cameraman with one camera. The time and length of each scene is governed by the surgeon. The lengthening of a scene with regard to smooth continuity and subsequent editing is determined by the photographer. When in doubt, it is always better to overshoot, although as much cutting and editing as possible should be done in the camera. "Dissolves" and "fades" and other special effects are left to the discretion of the photographer and should be used for smooth transition.

All specimens obtained during an operation may be photographed to the best advantage at the time of excision. They should be placed beside a centimeter rule near the site of the operation to show their size.

The close-up should take place at the point of climactic action in the medium shot. It is especially important in making such close-ups that the surgeon be reminded of the presence of the camera, so that in his concentration on his work he will not obstruct the view of the lens with shoulders and arms.

Figure 5. Complete set-up for surgical motion pictures. Note accessory kit on rear leg of tripod, tripod truck for easy mobility, multiple outlet box, and stepladder for support of cameraman.

Correct exposure is not a constant problem. An initial reading obtained with a reliable exposure meter at the site of the incision will govern all subsequent exposures. As darker tissues and deeper cavities are reached, a set increase in exposure becomes necessary. The proper technique of exposure can be established by the study of the films of several operations exposed in a similar manner. With the lighting equipment described in this article, the range of exposure at 24 frames per second is approximately F/5.6 for the first incision to about F/2.7 for a deep cavity. If panning is necessary strict attention must be paid to paralax control.

Usually the first and last actions of a process should be recorded for clarity, as in the making and suturing of incisions or in any procedure requiring a series of repeated or similar actions. In between scenes it is advisable for the photographer to maintain a constant check on focus, composition, spring tension, and remaining footage.

Scenes which cannot be obtained through photographing the living may be had with the use of cadavers, plastic or wood models, and animation. The other phases of medical motion picture photography, cineradiography, endoscopic photography, and time lapse procedures, because of the difficulty involved in their use, should be utilized only when absolutely necessary.

For best results all footage pertaining to a particular subject should be retained and processed at the same time. After processing, the rolls are spliced together and viewed with attention to cutting and editing. Poor editing can ruin an otherwise good film, so it is essential that the film editor have a clear understanding of his subject and exercise good judgment. The addition of descriptive narration and the inclusion of pertinent titles are the final steps in the production of the finished film.

Adequate equipment, adaptable materials, and skilled personnel are now available for the production of admirable medical motion pictures, which as a result have become adjuncts to training in surgery and other specialties. The medical motion picture today has become a more effective aid to the medical curriculum. Through proper planning and methodical production it will rapidly attain a position commensurate with its value to medical education.

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Somatotypes-Equipment And Procedure

Philip H. Mott

THE Somatotype, or Sheldon Body Type as it is sometimes called, is another use of photography as a valuable tool in the field of medicine. In his book, "The Varieties of Human Physique", Dr. W. H. Sheldon explains how investigations are being carried on and the resulting data being compiled to show the connection between a person's physical appearance and his physical health and affinity to disease as well as his mental health and personality.

To begin, a brief explanation of the Somatotype and its interpretation is in order. A system of classification has been worked out by Dr. Sheldon to enable the investigator to express the variables of the human form by a three digit numeral. The three terms, endomorphy, mesomorphy and ectomorphy are used to classify the three numerals that express, quantitively, the subject's possession or lack of these three components:

1. The Endomorph is described as underdeveloped, with a fat, round body, short extremities, and a relative preponderance of visceral mass.

2. The Mesomorph, on the other hand, is the over developed, muscular type, sometimes referred to as musclebound.

3. The third classification, the Ectomorph, is a spare individual, whose lack of flesh or muscle is at once apparent.

Each component is gauged on a seven point scale with the number 1 representing the minimum of that component and 7 its presence in extreme. For determining the degree of each, seventeen measurements are taken from the negative, to scale, by the use of dividers. Thus a 1-7-2 is the well proportioned individual as portrayed by Superman or Tarzan.

As with any research of this type, the resulting diagnostic value of the classifications increases and becomes more accurate as more and more investigations are carried out. By the same token, the value of these body type photographs increases only in proportion to the degree of uniformity with which they are made.

In conducting his investigations, Dr. Sheldon used a 9½ inch lens at the appropriate distance for the image of a person 78 inches tall to be within the short dimension of a 5 x 7 film. Allowing for the guides in the film holder, there is approximately 4¾ inches of useable film

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Figure 1. Use of the rotating pedestal.

on the short dimension and 6¾ inches on the long dimension. By using a 3 on 1 dividing back, the anterior lateral and posterior views are recorded side by side within the 6¾ inches.

Now, let's approach this with the viewpoint of a medical photographer who has been asked to produce Sheldon body type pictures. His problems are numerous. First of all is the question of space. Does he have sufficient floor area to allow a camera to subject distance of about 14 feet? Does he have or can he buy a 9½ inch lens? These two questions require answering at the same time. A long focal length lens will minimize distortion but, a small studio area will restrict him to a shorter length. In my own case it was a matter of using what I had, an 8 inch lens. However, I attempted to maintain the same proportions as used by Dr. Sheldon, that is, 78 inches to 4¾ inches. To find the camera to subject distance I used the formula $\frac{h'}{h} = \frac{f}{u\text{-}f}$ where

h' = image height
h = subject height
u = subject distance
f = focal length

then substituting known factors

$$\frac{4.75}{78} = \frac{8}{u\text{-}8}, \quad 4.75u - 38 = 624,$$

$$4.75u = 662, \quad u = 139.37 \text{ inches}$$

I soon found that this scale would not work because of the fact that the human form is a three dimensional figure. In each view a part of the feet was cut off. By trial and error I found that a subject distance of 149 inches left a reasonable margin of safety. Then using the same formula and substituting the new values I had

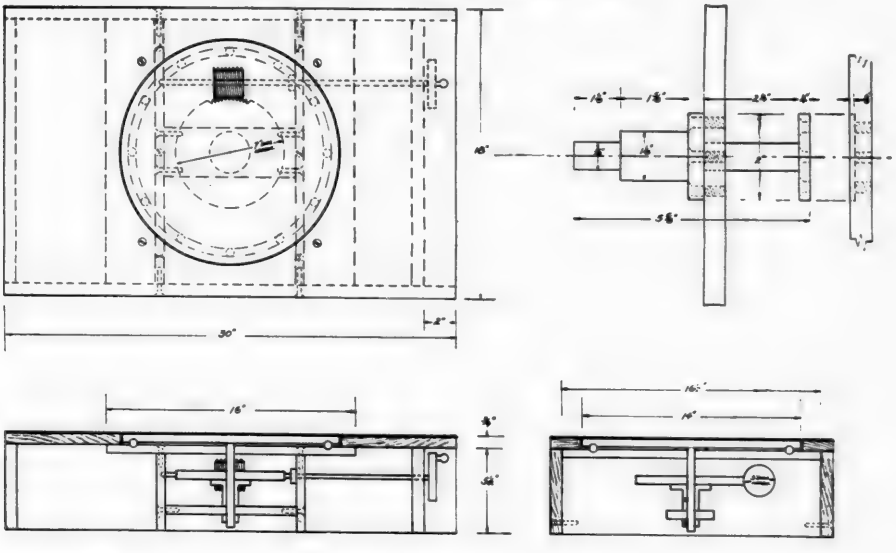
$\frac{h'}{78} = \frac{8,}{149\text{-}8}$ $\frac{h'}{78} = \frac{8,}{141}$ $141h' = 624$ then $h' = 4.425$ inches, image height.

Thus the 78-inch subject height produced an image of 4.425 inches with a subject distance of 149 inches from the lens to the imaginary central plane of the body. Thirty-nine inches above the level of the turntable was decided upon as the proper height for the camera lens as this is one-half of the 78 inches provided for.

The 149 inch mark comes at the center of a 14 inch turntable on which are lines for the heels and outside edges of the feet. Figure 1 shows the circumference marked for the quarter turns and the long lines on each side which serve as base lines on the negative. The subject is rotated for the anterior, left lateral and posterior views by a simple worm drive and hand crank. Figure 2 shows the construction details of such a turntable.

The subject should stand with heels about 2 inches apart, hands and fingers straight at about 8 inches from the sides, and look straight

Figure 2. Plan for the rotating pedestal.



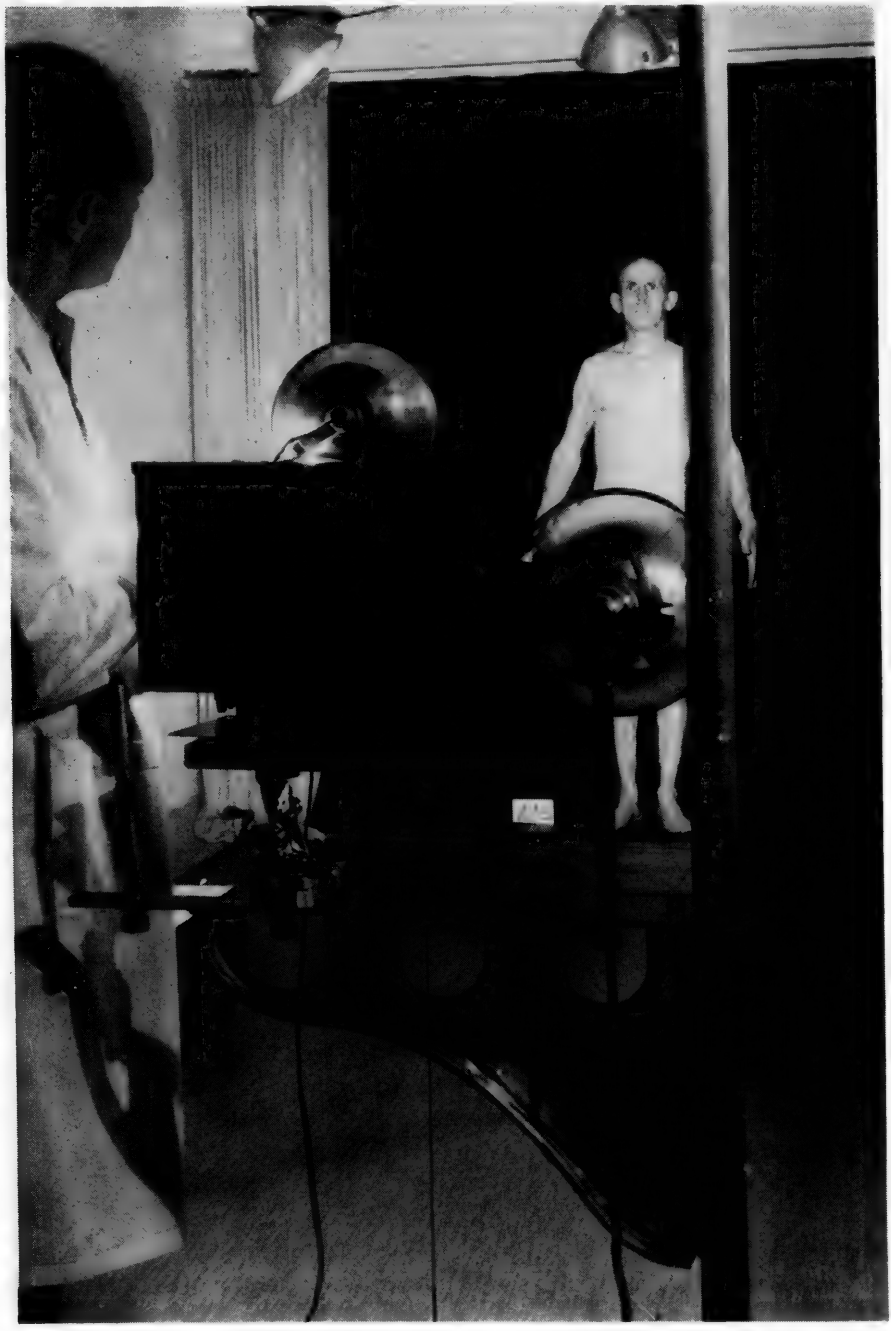


Figure 3. Position of the subject.

ahead. (See Figure 3), I use a black drape background for contrast and a No. 22 flash held at the camera for flat lighting. The exposure is f 32 open flash with a fast ortho film.

For convenience in setting up, the location of the turntable and the camera is marked on the floor. The bellows extension is also marked to insure identical results with each set up.

The real problem is to get a 5 x 7 dividing back for 3 on 1. Figures 4 and 5 show the dividing back which I designed and built to be used

Figure 4. Dividing back for an Eastman View Camera.

with an Eastman View Camera. Since, to my knowledge, there are no such backs on the commercial market, each must find the answer to this problem in his own way. The accompanying plan could probably be altered to suit other cameras; to anyone using the plans I want to draw attention to the black pile velvet light seal which is not shown on the drawing. This is glued to the back of the sliding member and a close but smooth working fit is necessary.

The next matter of concern is an accurate scale for taking the measurements. The ratio can be figured from the previously mentioned

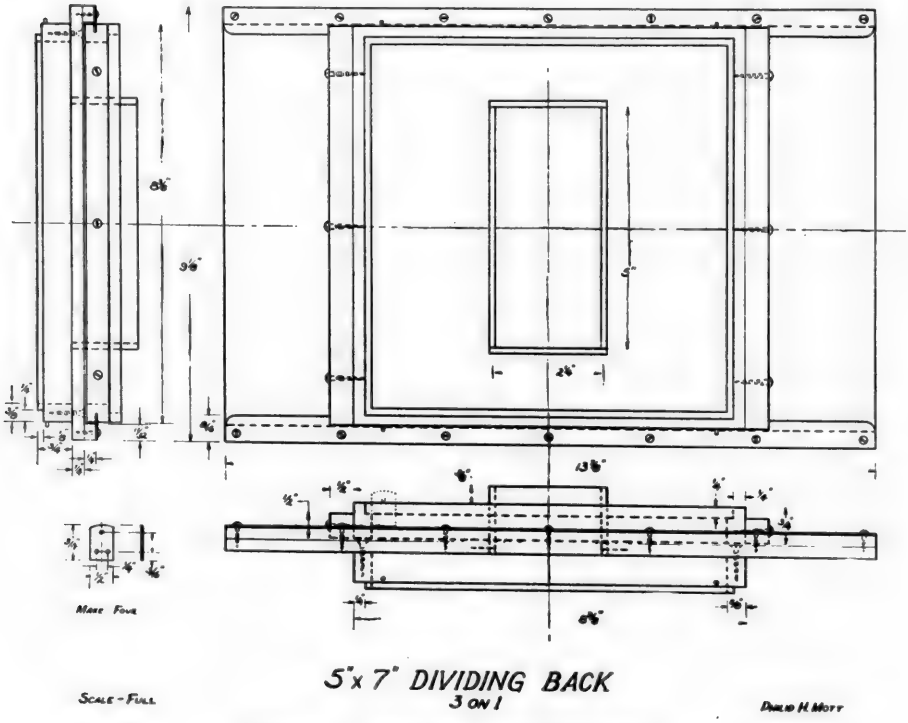


Figure 5. Design for the dividing back.

formula but the simplest and most accurate method is to mark off a board with 2 or 3 inch divisions and photograph it at the 149 inch subject distance. A grid of 2 inch squares marked on the wall as shown in figure 6 is naturally more desirable, and is the method used by Dr. Sheldon. This grid negative is then contact printed to a sheet of process film and the resulting transparent grid is laid over the somatotype on a view box, figure 7. With the base line of the grid coinciding with the base line of the somatotype, various anatomical measurements from the base can easily be determined. This also serves to give true horizontal and vertical lines for other measurements. The subject's weight and height should be recorded before the somatotype is taken.

The research being done at Queen's University is conducted by Dr. Malcolm Brown and is, in part, supported by the National Research Council of Canada. What will become of this research, I am in no position to say. Whether or not a method of predicting an individual's health or a means of diagnosis is developed that will become accepted practice, remains to be seen. However, we as medical photographers, can at least have our house in order. I don't contend that the methods

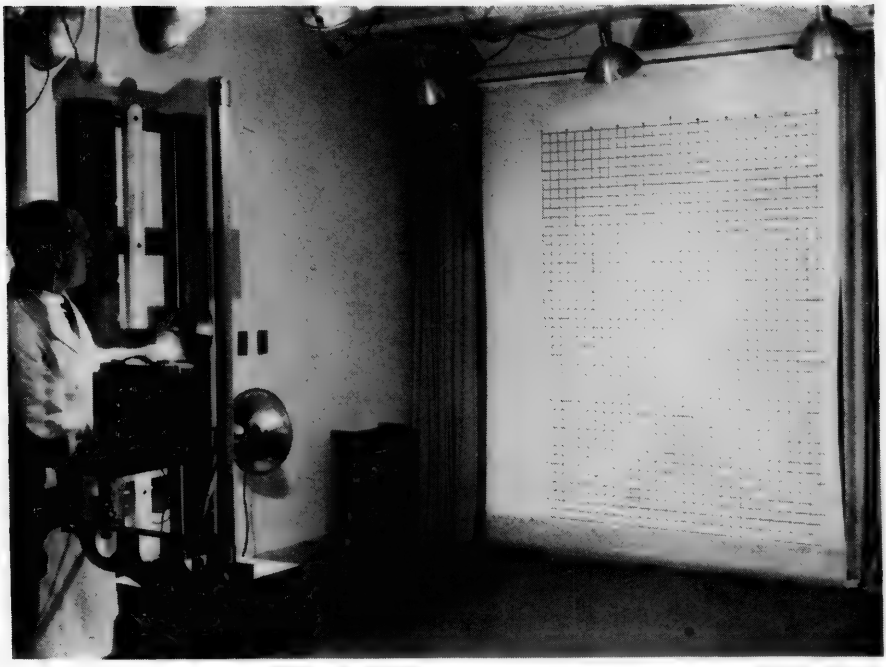


Figure 6. Wall grid of 2 inch squares.

or equipment described here are the best and only means, but it is at least a starting point. Other methods, with more efficient equipment, may be devised.

In conclusion I want to point out that medical photographers can contribute a great deal in this phase of medical research by turning out a product that lends itself to interchangeability, so to speak, a product that can readily be passed around and be interpreted with equal results by all interested investigators. For that reason I want to stress that we should strive for uniformity in a branch of our work where uniformity is so important.

Figure 7. The grid placed over the somatype on a view box.

Book Reviews

CAMERA AND LENS. Book I, of a series of six books by Ansel Adams, in the new Morgan and Lester Basic Photo Series. 120 pages, 28 diagrams, illustrated with 49 reproductions of Ansel Adams' fine photographs. Published by Morgan and Lester, New York. $4.00 per volume.

The first volume of "Camera and Lens" radiates the spirit of Mr. Adams, both as a photographer and as a great teacher.

It deals with the functions of the camera and lens, choosing equipment, camera adjustments, lens coverage, selection of lenses, optical visulation, perspection, etc. Shutters, miniature cameras and lenses receive their share of attention.

Flash equipment, studio and darkroom layout are covered very thoroughly. There is a fine chapter on lens data, and also some excellent ideas on field and basic equipment. A complete index occupies the last few pages.

"Know what you are after, *before* you begin!" These words of Mr. Adams carry a volume of common sense. What a different approach most of us would have, if this thought of the basic principle of good photography were used in picture taking!

After reading this book, it is easy to understand why Ansel Adams is considered a great teacher. It is one thing to possess knowledge and quite another to impart it to someone else.

If the remaining five volumes of this series are equal to the standard of this first one, Mr. Adams has made one of the most important contributions to our photographic literature in the past two decades. It is not too technical and his style is easy to read. "Camera and Lens" is not intended as a textbook, in fact several standard textbooks are referred to for more detailed study. It covers, in a clear concise manner, the fundamental facts and knowledge needed to intelligently choose and use the equipment necessary for producing good photographs.

PHOTOGRAPHIC FACTS AND FORMULAS by E. G. Wall, F.C.S., F.R.P.S. and Franklin I. Jordan, F.R.P.S., F.P.S.A. 1947 Revised Edition, 364 pages, $5.00. American Photographic Publishing Company, Boston, Massachusetts.

This volume is a practical working guide and darkroom companion to the busy photographer. It was introduced in 1924, revised in 1940, and again revised in this 1947 edition.

Many obsolete processes have been deleted, but older formulae which have proven their permanent worth are retained. There are twenty-five chapters and a complete twenty-five page index.

The younger workers in the field will obtain a sound photographic educational background through the study of this volume. "Facts and Formulas" will tend toward making one a better darkroom technician. This book could take the place of several volumes of the older books one usually finds in a serious worker's collection.

There are a few well drawn diagrams where they are necessary to illustrate an idea, most of which are in the "optics" chapter. There are no other illustrations, for none are necessary; the description matter is adequately plain and concise. It is to be recommended as an excellent example of a book that will help answer your questions.

RAY MIESS

Color Photography In Plastic Surgery

John C. Detro,* M.D., F.A.C.S.
and
John J. Beiter, ** F.B.P.A.

PLASTIC surgery concerns itself largely with the correction or restoration of tissue defects, the origin of which may be congenital, traumatic or the result of disease, such as new growths or infections. It is one of the oldest branches of surgery, dating far back into antiquity. In those early days, and even later, its practice was jealously guarded in a guild-like manner. Being shrouded in secrecy, the knowledge gained was not available to others, and many procedures alleged to have been accomplished are still unknown. There was a long period of many centuries during which the subject as a whole was lost sight of; but early in the last century, scant reports lead us to believe that sporadic workers again explored the possibilities of the field, often from necessity, and apparently achieved some remarkable results, although without benefit of anesthesia and knowledge of the cause or prevention of infection. The technique of these procedures accomplished in this period of Renaissance were not available to contemporary surgeons, nor later to us, because of the lack of a vehicle to disseminate the knowledge gained. Medical journals did not exist. Such medical books as were written and published in that day, dealt almost exclusively with the immediate medical and surgical problems of that time. The illustrations in these early books were infrequent and consisted only of sketches. These conditions, together with the difficulties of communication and travel, undoubtedly served to retard medical advances, including reparative surgery.

There is little question that the recent impressive progress in plastic surgery has been furthered tremendously by the availability of photography, which plays such an important part in planning the operative procedures, in teaching, and in recording the results obtained for comparison.

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There has been considerable misconception among the laity about plastic surgery. Their knowledge of the subject has been formulated, or abetted by screen and fiction, where the rapid and perfect results portrayed could rarely, if ever, be duplicated except by an act of Diety. Because of these standards of perfection often expected by the patient, he requires sympathetic re-education by his physician. This often requires several consultations before he has an intelligent understanding of the surgery contemplated and what kind of a result may be reasonably anticipated. He learns that operative scars may at times be concealed from ordinary view, but never obliterated. It is explained to him that a disgfuring scar on his face can only be exchanged for a less conspicuous one.

The major part of plastic surgery involves correction of functional abnormalities. While the effects of these mechanical handicaps upon the individual are obvious to all of us, we often fail to appreciate the profound and far-reaching mental effects upon the owner, which may even approach despondency. This is especially true of a facial disfigurement. These people are frequently denied their normal and reasonable share of happiness and are sometimes prevented from following a career of their choice. Their social status and earning capacity may have been jeopardized. Occasionally, their sensitiveness about their affliction is reflected in mild mental aberrations or depression. It is important for the photographer to be sympathetic to these reactions in his contacts with the patient. Although the photographer has seen similar conditions in his work, he should guard himself strictly against making any comment about the situation or its prognosis. On occasion they forget the details or seriousness of the original condition after it has been corrected and adjusted. An original photograph serves to refresh their memory and when the end result is not the perfection they have anticipated, they feel more satisfied with the achievements of mere man. More often, the end result appears to please the patient more than the operator.

The end result of a plastic operation is usually exposed to view for criticism or compliment by both patient and observer as contrasted with most surgery in other fields in which the actual result is buried from sight, leaving only a postoperative scar in the skin as a memento. Usually, this incisional scar is concealed by clothing and interferes in no manner with function. In fact, the possessor on occasion displays this residual scar with considerable pride as "his operation". In plastic surgery quite the opposite is true. The patient usually dislikes to discuss "his operation" and his appreciation is the greater, the less the

visible scarring. Many plastic procedures cannot be completed in one operation, but must be done in stages, with lapses of time between them to be sure that an adequate blood supply has been established in transplanted tissue, or to allow stretched skin to readjust itself. Here, photographs are invaluable in visualizing the progress and further planning of subsequent operative stages. Color is especially helpful in these serial studies.

The introduction of color in clinical photography has shown a marked advance over black and white. The gray tones of the latter require color translation thus making demands upon the imagination. Color gives a sense of depth not found in black and white. Skin coloring is faithfully reproduced as is the vermillion of mucosa. In plastic procedures in the facial region, especially skin grafting, the photographic reproduction of these variations is of considerable importance. Skin pigmentation is in part dependent upon racial difference, but few appreciate the variations of skin coloring in different regions of the same body. The intrinsic color of skin in the white race is yellow, there being no such color as "flesh color". For example, the skin of no other part of the body exactly matches that of the face. The nearest match is the skin behind the ears and on the neck. These individual variations are largely due to differences in the vascularity, but may be influenced by pigment changes due to sun and weather or even disease.

A clinical photograph in color requires the closest cooperation of surgeon and photographer in its taking. It cannot be ordered on a requisition form like a radiograph. Regardless of the skill of the photographer, he must have as a minimum, detailed advice from the doctor if the picture is to demonstrate the abnormality with complete honesty as it actually appears to the eye. An ideal picture should tell its story without words. To approach this ideal it is best for the doctor to be present when the picture is taken. Frequently the operative area is bandaged. Dressings used in plastic work are usually specialized and complicated. Even if it were a simple cover bandage, the photographer should never have to assume the responsibility of removing the dressing or reapplying it. It is not sufficient for the doctor to approve the composition and projection as viewed from behind the camera. He should also look at the ground glass image. The value of this procedure has been demonstrated repeatedly. This image is what the camera sees, and what it will record on the film. If the image does not reveal or emphasize what the physician wishes in the picture, the photographer then can readily make the necessary changes.

The utmost honesty is the ideal goal sought in photographing plastic

surgery cases. It requires this honesty on both the part of the doctor and the photographer. It is fundamental in human nature to put our best foot forward. We like to display excellence in achievement and dislike to reveal our errors and shortcomings. In this work it is of extreme importance to portray the situation as it actually exists, otherwise the values and goals we seek and strive for, are lost.

So that normal skin tones may be faithfully reproduced by the camera, it is the doctor's duty to advise his patient to leave off all cosmetics, as scars especially in facial operations should not be concealed or depreciated. The only exception to this recommendation is the occasional case in which it is desired to demonstrate the application of cosmetics or Covermark, to further conceal defects which perhaps are not fully amenable to surgical correction. Although their use is obvious in the color picture, medical ethics dictate that this fact be noted in the written description or accompanying diagnosis. The clinical photographer on his part should keep an accurate record of the technical factors in every exposure so that he may duplicate them. He should review any previous pictures taken of the same subject before taking "repeat" pictures. It is only with attention to these details that he can produce pictures of real comparative value.

It is well to remember that clinical photography is remote from portrait work. A soft focus portrait which has been artfully retouched, flatters the ego and not infrequently engenders wistfulness in the subject. This is perhaps justified and necessary commercially, however it would defeat the purpose which a clinical photograph serves, as well as the usefulness of the photographer. Sharp focus is always a "must". Sometimes the photographer's best intentions may be swayed by subconsciously wishing to flatter the end results.

In X-ray work recourse is often made to the taking of comparative films, one showing a known normal. This same procedure can be used to advantage in color photography. An abnormality is much more conspicuous when viewed with the normal for comparison.

Not all pictures are of cosmetic procedures as not infrequently, the problem is solely one of function. While it is true, that only motion pictures could demonstrate certain functional conditions, and perhaps do full justice to others, it is quite within the range of still photography to demonstrate certain problems in a satisfactory manner. Motion, or its restriction, can often be suggested nicely by a preoperative picture in which a crippled hand or arm is photographed with the uninjured member for comparison. The suggestion is enhanced by a postoperative picture similarly taken. In this manner, many functional defects and

their correction can be recorded using still photography. In photographs in operative procedures, instruments shown purposely grasping structures and probes inserted into anatomical openings or beneath structures, simulate a degree of motion not present without them.

All plastic operations require careful and studied planning before they are attempted by the surgeon. A preoperative color photograph can be studied at leisure by him to decide the operative procedure, without the presence of the patient. The postoperative picture serves for comparison and tells what improvement has been accomplished. These pictures are of value to the doctor and of no little interest to the patient. They become part of the case record, although not filed with it, and are available for future reference if it is desired to present the case at a meeting or to write an article for publication.

In the numerous ramifications of medical legal practice, color photographs can play an extremely important part. Their testimonial value approaches that of an eye witness. They give life and truth to the cold legal-phrasing of words which so often seem to either minimize or exaggerate the facts.

One of the requirements of the candidate for certification by the American Board of Plastic Surgery is the submission of twenty-five diversified case reports illustrated by unretouched photographs showing the preoperative condition, the progress and end result. These case reports remain in the Board's library permanently. Fellowship in the American College of Surgeons also requires among other credentials, presentation of case histories. In the field of plastic surgery, these case histories would be quite barren if not illustrated by actual photographs in addition to sketches of operative steps.

Summary

1. Photography is a necessary adjunct to the practice of reparative surgery.
2. Color photography has a tremendous advantage over black and white reproduction. The pictures taken have life, look natural and more closely approximate the appearance of the living subject. At present, no other medium of illustration can so forcefully present the truth.
3. It has been proven from actual experience, that the application of color photography promotes better surgery. Consequently, better surgery is reflected in the benefits which the patient receives, and of course, it is always the patient who is our first concern.

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Stereoscopic X-Rays To Photographic Positives

William W. Brewer

ALTHOUGH the principle of the stereopticon is not new and stereoscopic X-ray is common in larger medical institutions, especially teaching centers, the value of the photographic positive from stereo X-rays has not yet been fully realized nor publicized. Being the medical photographer at the University of Kansas Medical Center brings one into close contact with every type of photo-medical trick that can be conjured to enhance the scope of medical teaching; the stereo X-ray positive is such a trick.

The principles are simple and the following discussion and pictures will show that the medical photographer, with standard equipment and patience, can devise an excellent set of teaching illustrations.

The three illustrations are representative steps in any case that might be encountered. The case illustrated herein is the stereo visualization of the coronary circulation of the heart.

Step number 1 is taking the original X-rays of the heart that are made by exposing two X-ray plates. Each plate is exposed with the cone of the X-ray machine at a different location, to the right or left, from the other. This accomplishes the same purpose as taking a stereo picture with a camera using an eccentric base arrangement to obtain two pictures with slightly offset views. After standard X-ray development the X-ray plates are usually viewed in a prism mirror arrangement which is extremely immobile, of considerable weight, and although very effective is not practical for teaching purposes where a large number of students wish to view many interesting cases. To correct the above condition the stereo positive becomes necessary.

Step number 2, illustrated by the copy setup, (figure 1) is accomplished by copying the two X-ray plates. An ordinary copy camera and X-ray viewer are essential. The camera should have a split back and sliding front to perform the task of locating each X-ray image in its proper place on the camera film. It is imperative to have the X-rays identified in right and left order as they were taken by the X-ray machine. The left X-ray will appear in the right half of the copy back.

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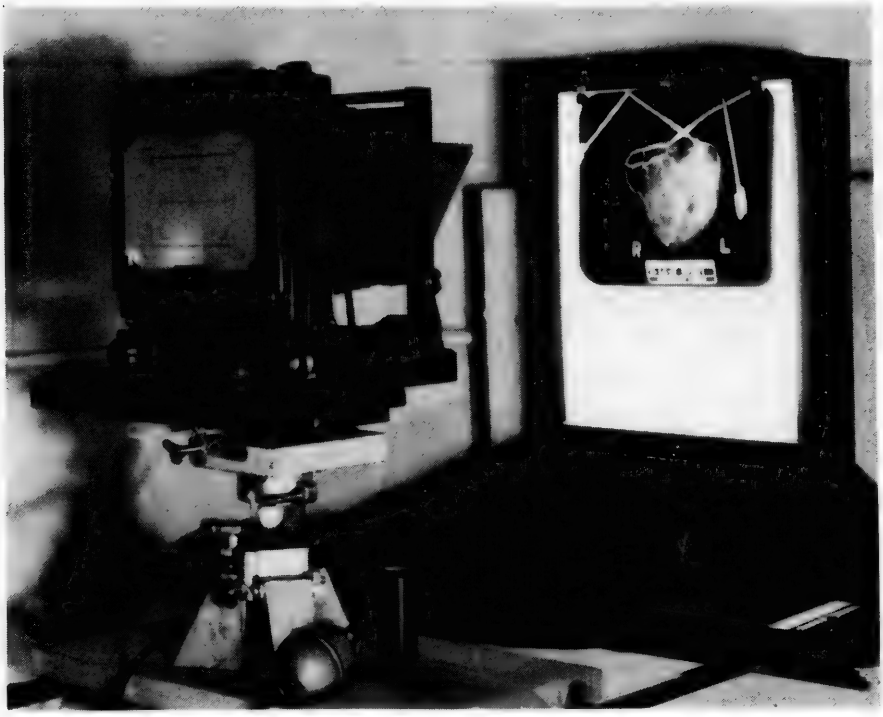

Figure 1. Copy setup.

The right X-ray will then replace the first on the viewer and is copied on the left half of the camera film. If by chance they become reversed in the copying arrangement, the finished stereo will have the appearance of being viewed through the back of the subject.

Figure 3. Observation of the stereo positive using a stereopticon.

The reduction made from the two films must be of a size that the center of the two images in the finished print will be the same distance of the eye pieces in the stereopticon used to veiw of the final positive.

At this point it may be stated that X-ray tone scales, are, at best,

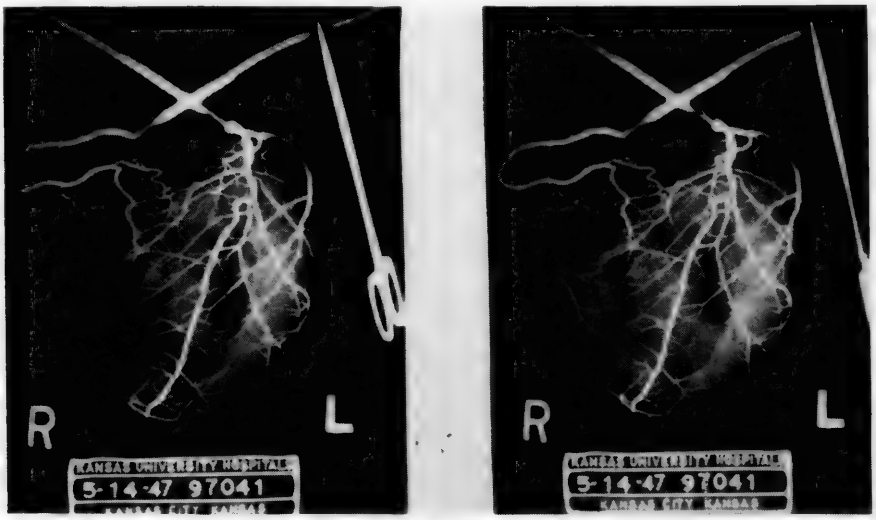

Figure 2. The complete stereo positive seen full scale.

difficult to reproduce. Correct exposure with a meter and use of panchromatic film has been found advisable in copying.

Developing, drying, printing of the copy film will produce the complete stereo positive seen full scale in figure 2. The stereo positive is then cut out and reviewed in a stereopticon as shown in figure 3. Any type of viewer can be used. Many cases can be presented in this manner to a group quickly and conveniently.

The Prevention of Moulds in Color Photography Dye Solutions

To prevent moulds in color photography dye solutions simply add a small "pinch" of Phenylmecuric Chloride ($C^6H^5HgOH.C^6H^5HgC^1$) to the dye solution. Diluted dyes (Eastman's Transfer Dyes) can be kept for nearly a year at room temperature without showing any sign of mould growths. The quantity of Phenylmecuric Chloride required is so small that it does not effect the working of the dyes in any way. This remedy was suggested by Doctor E. E. Ecker, Western Reserve University.

FRED S. BEAL
St. Luke's Hospital
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Association News

NEWS ITEMS

THE BPA TRAVELING SALON of about 60 prints was shown in Chicago with the AAAS international exhibit of "Photography in Science", along with the photographs on "Atomic Energy" collected by the editors of Life Magazine. The exhibit was held December 26-31. Publicity was given this triple exhibit in the December 12 number of "Science." The announcement described the BPA as "the leading association in the development of photography as a tool for biological research."

Members of our Chicago Chapter attended to the hanging of our prints and reported that considerable interest was shown in them by visitors to the exhibit. At the close of the AAAS meetings, the Chicago Chapter retained our prints for exhibit at the Illini Building and the Chicago Camera Club. It will then go on tour.

Mr. William Stevenson, Photographic Department, Mt. Sinai Hospital, Cleveland 6, Ohio, is in charge of the Traveling Salon. Requests for the Salon or for information about it may be sent to him or to the BPA Secretary.

THE AAAS PHOTOGRAPHY IN SCIENCE EXHIBIT was reviewed in "Science Monthly," Vol. 66, No. 2, January 1948, by Lt. Alexander J. Wedderburn, associate curator of the Division of Graphic Arts, Smithsonian Institute. Besides his article, the Society's heightened interest in photography was evidenced by a whole page of photonotes at the back of the journal. For the most part these had to do with equipment or processes, such as the Fish-Schurman Corporation's newly developed lamp for photomicrography; and Douglas Winnek's Tri-vision stereoscopic photography. Evidently the editors of that journal have at some time shared the uncertainty many workers feel as to what size negative they will adopt for scientific records, as, among the more technical items, the following note appeared:

> "Professional-size pictures are generally 8x10 inches, the Eastman Kodak Co. tells us, but the improvements in equipment make it possible to get the necessary detail and accuracy in smaller size, so Kodak's new view camera makes them 4x5 inches. The quarter-size negative is economical and still can be enlarged and touched up professionally."

BPA WINNERS IN THE AAAS EXHIBIT were Mr. Ralph O. Marts of the U. S. Forest Products Laboratory, Madison, Wis., who won

third place in the color division for a 35mm. color fluorescence photomicrograph showing the vascular bundle in fern; Miss Jane Glaser of the Merck Institute, Chicago, Ill., whose series of color prints showing the reaction of animal-growth to radioactive substances won honorable mention in the color division; and Mr. H. Lou Gibson of the Eastman Kodak Co., Rochester, N.Y., who won honorable mention in the black-and-white division for his four-picture illustration of a method of photographing insects having a true metallic silver coloration.

THE SECOND INTERNATIONAL SALON, "PHOTOGRAPHY IN SCIENCE" will be held under the auspices of the Journal "The Scientific Monthly" in Washington, D.C., in September, 1948, in connection with the Centennial Meeting of the AAAS, September 13 through 18. This announcement, coming just after the close of the First Salon shows that the venture was considered a decided success by its sponsors.

TWO CLIPPINGS ABOUT PHOTOGRAPHY IN MEDICINE have been mailed to us by Ralph Creer. One, which appeared in the Journal of the A.M.A., Vol. 135, No. 4, Sept. 27, 1947, concerns the use of photographic display-set to combat the spread of venereal disease in England. The exhibition was produced for the Ministry of Health with the cooperation of the Central Council for Health Education. It was offered in 1945 to factories and other managements employing over 500 people. So far it has been borrowed by 155 factories and 53 local authorities. Apparently it has made an impression, particularly among the younger workers. The most frequent comment appearing on factory reports is that it should have been made available earlier.

The other clipping was from the British Medical Journal, November 1, 1947, p. 710: It was a letter from H. Mandiwall, F.R.P.S., member of the BPA and Chairman of the Royal Photographic Society's Medical Group. The excerpt was headed "MEDICAL PHOTOGRAPHY IN BRITISH MEDICAL JOURNAL" and read as follows:

> "Sir,—At the last committee meeting of the Medical Group of the Royal Photographic Society it was unanimously agreed that I, as Deputy Chairman of this Group, should write and congratulate you on the splendid reproduction of photographs in your JOURNAL of September 27, illustrating various articles. My Committee feels, however, that the reproduced photographs would not have been possible without the excellent originals, and that the photographers concerned should have been recognized and acknowledged by the authors. My Committee are sure that this would give great encouragement to all medical photographers."

Mr. Creer adds that the reproductions referred to appear between pages 482 and 483 of the September issue of the British Medical Journal, and are very well done.

THE FIRST WOMEN'S INVITATION EXHIBITION OF PHOTOGRAPHY was held November 1 to 30 at the Camera Club in New York City. (What with this exhibit, the AAAS First International Salon and our own First International Salon of Biological Photography, 1947 seems to have been a year of Firsts.)

As might be expected, most of the forty contributors to the women's exhibit were pictorial, fashion or portrait photographers, and many well known names appeared among them. Equally well known, at least to us, were the names of the scientific photographers: Miss Avis Gregersen, University of Southern California Medical School; Mrs. Maria Elsasser Ikenberg, University of Illinois College of Medicine; Miss Grace MacMullen, Babies Hospital, Columbia University Medical Center; and Miss Stella Zimmer, F.B.P.A., College of Medicine, Syracuse University.

THE PHOTOGRAPHIC SOCIETY OF AMERICA has two Traveling Print Shows of about 35 prints each, showing the modern use of photography in science and industry. They are available to PSA groups, camera clubs, technical societies, engineering societies and other scientific organizations from December 1947 through November 1948. Requests stating where the prints would be hung, the available hanging facilities and any preference for dates should be made to Earl R. Clark, 184 Malden Street, Rochester 13, N.Y.

BIOLOGICAL PHOTOGRAPHERS ARE LESS EXHIBIT-MINDED than their colleagues, the pictorialists. The pictorial photographer takes his picture for the picture's sake and thereafter justifies his efforts by doing all he can to have his picture seen. Scientific photographers take their pictures for a variety of reasons, among which a primary interest in the picture itself is seldom included. Having obtained a record they are apt to feel that their duties toward that particular shot are over. They do not stop to think that besides being a record for scientists their picture is a record for photographers. It illustrates a method of treating a subject or a class of subjects and can be stimulating to other workers. The biological photographer is being modest, but also unimaginative, when he fails to give his pictures a chance to convey the utmost of which they are capable. Apparently this non-exhibitionism is wide-spread. In the November-December number of the Royal Photographic Society's Journal, section B, there

was a review of the medical section of the 1947 annual exhibition which had a familiar ring:

> "With the constantly increasing interest in Medical Photography one would reasonably expect a commensurate increase in the number of examples in this years' exhibition, and the quality should be exemplary. Quality is well evident, also variety, but the quantity is not by any means overwhelming."

MORAL: BEGIN NOW TO PREPARE YOUR PRINTS FOR THE BPA 1948 SALON!

THE LEONARD WOOD FOUNDATION (American Leprosy Foundation) has appointed the following BPA members to its Committee on Photography: Mr. Charles Brownell; Mrs. Perry Burgess (Honorary Director of Photography of the Foundation); Mr. Ralph P. Creer, Committee Chairman; Mr. Leonard Julin; Miss Anne Shiras, Committee Secretary; and Mr. William Taylor. Mr. Don Mohler of the General Electric Company is also on the committee and H. Windsor Wade, M.D., Editor of the International Journal of Leprosy, is acting in an advisory capacity.

Comparable photographic records from the leprosaria throughout the world are needed in the research work now being undertaken by the Foundation. In some places, these records must be made by individuals who have had little or no photographic experience. The Committee on Photography has been asked to recommend equipment and methods which will be capable of producing records of the requisite quality, and yet which are simple enough to be comprehended from a manual or a short source of instruction.

Reports on the photographic committee's recommendations will be made to the BPA from time to time. At a meeting in New York, November 10 and 11, the committee met to discuss equipment and the standardization of methods, but the conclusions reached are still tentative. Mr. William Taylor spent from January 26 to February 4 at the leprosarium in Carville, Louisiana, field-testing equipment similar to that tentatively recommended by the committee. As the work progresses, information about photographic methods and samples of the results will be disseminated by means of the International Journal of Leprosy, meetings of the International Leprosy Association, and the courses given to workers in leprosy who come to this county for study.

"MEDICAL MOTION PICTURES IN PRIVATE PRACTICE," an article by BPA member Donald W. Leonard, M.D., appeared in the

New England Journal of Medicine 237:540-543 (Oct. 9) 1947). The article contains this note: "An inquiry among active members of the New Hampshire Medical Society early in 1947 disclosed the following figures from the first two hundred replies: Owners of motion picture cameras, 65 (32.5 per cent) with 16 who had taken films of patients and 8 who had asked others to take pictures; physicians who did not own motion-picture cameras numbered 135 (62.5 per cent), those who had taken pictures with cameras belonging to others, 20, and those who had asked others to take pictures, 13. Potential motion-picture makers thus numbered 98, or 49 per cent of physicians who made replies. Relatively few of the physicians in this "interested group" are specialists or are associated with clinics having photographic departments. It therefore seems that clinical motion picture records in private practice should be emphasized as a practical development of this interest."

AN ARTICLE BY LEO MASSOPUST, "Infra Red Photographic Study of the Superficial Veins of the Thorax in Relation to Breast Tumors" appeared in the January 1948 number of "Surgery, Obstetrics and Gynecology." Besides a summary of the findings obtained by the infra-red photographic methods which Mr. Massopust outlined at our Rochester meeting, the article contains a number of excellent photographs.

"THE PREPARATION OF PHOTOGRAPHS FOR PUBLICATION", a well-illustrated article by Stanley J. McComb, Section of Photography, Mayo Clinic, appeared in "Post Graduate Medicine" Vol. 2, No. 6, Dec., 1947. All our members will find it interesting, for those who are already familiar with the standards of photographs for publications are often asked for advice by those who are not. This article is a valuable reference-work which can be recommended to all who want information about the preparation of photographic illustrations for publication.

EDITORIAL ASSISTANCE BY DR. EMMET SHIPMAN, BPA, Milwaukee State Teacher's College, Wisconsin, helped in the completion and publication of Mr. Lewis L. Kellsey's "Corrective Photography", an elementary illustrated textbook on camera swings and how to use them, recently published by L. F. Deardorff & Sons, Chicago, Ill.

MR. WILBUR C. LOWN is no longer in Bethesda, Md., but is now Major W. C. Lown, AUS, Signal Corps Photographic Center, Long Island City 1, N. Y. He is Project Officer in the medical training-film program.

MR. ZANE H. PRICE has left the College of Medical Evangelists, Los Angeles to organize a department of visual education and photographic science at Walla Walla College, College Place, Washington.

MR. GABRIEL EVANCY, artist-photographer at Columbia Hospital, Milwaukee, Wis., is transferring to Columbus, Ohio, to become medical artist for Dr. Robert M. Zollinger of Ohio State University.

MISS CAROL KERR, who graduated from the Medical Photography School of the Rochester General Hospital, Rochester, N.Y., last fall is now in the Department of Medical Photography of the Mt. Sinai Hospital, Chicago, Ill.

THE BPA HAS NEW LEAFLETS explaining our aims and activities and containing an application blank on the last page. We are largely indebted to Mr. Stanley McComb, Mr. Robert Sage and Mr. Leo Massopust for their production. Any member or Journal subscriber who wishes some for distribution may obtain them by writing to the Secretary of the Biological Photographic Association, University Office, Magee Hospital, Pittsburgh 13, Pa.

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Committee Report on Motion Pictures

14th Report of the Committee on Motion Pictures, 1947

I. FILMS REPORTED BY OUR MEMBERS.

T. H. Alpin: Arytenoidectomy, 400′ CSi.

Laurence B. Brown: Studies of foetal respiration; Rabbits in utero, 16 mm C.

Ralph P. Creer: The medical motion picture—its development and present applications. 16 mm 1100′, SCo. Available from Com. on Motion Pictures, American Medical Assn., Chicago 10, Ill.

Samuel C. Dunton: Stars and stripes 400′, SCo; Younger generation, 400′, CSi; New Ideas, 400′, CSi; Tree top acrobats, 400′, CSi; Safari in the Bronx, 600′, CSi; Giants in armor, 300′, CSi. All 16 mm.

Wynne S. Eastman: Transverse posterior nephrolithotomy, 600′, Si; Cervical fusions, 16 mm 1000′, CSi; Embryonal adenomyosarcoma, 16 mm 200′ CSi; Foster reversible bed, no data.

Jules Erdtrachter: Surgical repair of congenital cleft palate, 800′, C; Bone graft reconstruction for traumatic saddle nose deficiency, 800′, C; Correction of the congenital protruding ear, 800′, C; Correction procedure for traumatic dehiscence of the parotid duct, 800′, C. Films available from Dr. R. C. Seeley, 133 E. 58th St., New York 22.

Dr. E. J. Farris: Spermatozoa of fertile and infertile men; New methods of semen analysis; Moving sperm as an index of fertility in man. Second and 3rd made with the phase microscope.

Leo Goodman: Gelfoam in oral surgery 700′; Exodontia under general anaesthesia, 1200′; Perineal and public prostatectomy, 1400′; Sodium pentothal in oral surgery, 800′; all 16 mm CSi.

Allen Hancock: Prostectomy, 350′; Intubated ureterotomy, 250′; Adrenal tumors, 150′; all 16 mm C.

Dr. Paul H. Holinger: Diseases of the ear, nose and throat, 800′; Tumors of the bronchi, 400′; Diseases of the esophagus, 650′; The infant larynx 350′; Organic disorders of the larynx, 700′; all 16 mm CSi. These endoscopic films available from Jacques Hollinger Memorial Fund, 700 N. Michigan Ave., Chicago 11, Ill.

William J. Kelley: Micro-second x-ray (4000-8000 frames/second), C and B&W.

Mervin LaRue, Sr.: The fenestration operation; Continuous spinal analgesia; Intravenous anaesthesia; Modern trends in intravenous therapy; Pentothal sodium in obstetrics; Surgical treatment of analrectal lesions.

David Lubin: Transthoracic vagotomy, 600′; Osteototomy of mandible for correction prognathism, 400′; 16 mm CSi, not yet available.

Dr. Robert Mallory III: A normal delivery, primigravida, 500′ 16 mm CSi.

Phillip H. Mott: Insertion of Smith-Peterson nail, 300′; Palpation of the abdomen—pregnancy, 200′; 16 mm CSi.

Herbert S. Warren: Dissection of palm of hand, 16 mm CSi.

Julius Weber: Amputation of leg in diabetic gangrene; A study of filaria in the stomach of a tick; Low power cinephotomicrography with "Zoomar" lens system; Infra-red cinephotomicrography of blood vessels.

C = color; Si = silent, Co = sound.

Henry Roger and D. H. Ferris report making films, but gave no titles for listing in the report. Warren's film was reported as Ansco Color. New technics are being used by members: high speed x-ray, infrared, phase and Zoomar

lens. This year 11 requests for films were received by the committee from 7 states. All data available (prices excepted) are published. It would be helpful to your committee if you would state in your reports to us next year whether films are to be available.

II. FILM NEWS.

At the American Association of Anatomists meetings an evening was given over to films. Abstracts from 8 films are to be found in *Anat. Rec.*, 1947, 97(3):113-116.

The American Society of Zoologists had 5 films in the demonstration session and abstracts of the films are published in *Anat. Rec.*, 1947, 99S:69-70.

Wilbour C. Lown reports the following Navy Training Films: MN-2050b Indirect technique for inlays, MN-5368 Endodontia, MN-5369 Operative dentistry, MN-5370 Periodontia, MN-5371 Jacket crown construction, MN-0318b Oral hygiene. For information and availability address Naval Dental School, Bethesda 14, Md.

The International Scientific Flm Association Congress was held in Paris October 2-9. Council; Pres. M. Korngold (Poland), Vpres. J. Maddison (Gt. Britain) and Prof. Pinto (Brazil), Sec'y. M. Jean Painlévé (France), Treas. M. Sellaz (Switzerland) and 1 delegate from Australia, Belgium, Canada, Czechoslovakia, Malaya and Mexico. The 1948 Congress will be held in Gt. Britain in Oct. Information may be had from the Scientific Film Association of Great Britain, 34 Soho Sq., London W1. (From *Nature*, 1947, 160:601.)

III. CATALOGS

Guide to U. S. Government Motion Pictures. Motion Picture Division, Library of Congress. 1947, Vol. 1, No. 1, 104 pp., 40c. Government Printing Office, Washington 25, D.C.

A catalog of professional motion picture films. Academy-International of Medicine and Academy-International of Dentistry Room 202, 214 W. Sixth St., Topeka, Kansas. 1947, 31 pp. Films are listed under regions of the body headings. Many films are listed as well as a short list of sources. Doctors are requested to submit titles of other outstanding films to the Academy for possible inclusion in the catalog.

A list of medical films which may be used in professional training, Veterans Administration, Washington 25, D.C. 1947, 129 pp. Many films listed under 41 sections and 3 pages of sources.

Catalog of films from Great Britain, Britsh Information Service, 30 Rockefeller Plaza, New York City. 1947.

Catalog of films of general scientific interest available in Great Britain. Compiled by the Scientific Film Association, available from the Association of Special Libraries, London, 1946. 188p. 5s. This and previous note from the April 1947 issue of *Biologia.*

IV. PREVIOUS COMMITTEE REPORTS

The reports were initiated in 1935 and the data on films in each report are useful and except for new editions are not repeated in subsequent reports. To facilitate finding these in this *Journal* they are listed here:

1935, 3:141-4, 3:194-5, 4:215-20; 1937, 5:205-7; 1938, 7:92; 143-145; 1939, 8:95-7; 1941, 9:165; 1941, 10:102, 1943, 11:136-8; 1944, 12:188-189; 1945, 13:150-151; 1946, 14:140-1; 1947, 15:162-2.

V. PUBLICATIONS OF INTEREST FROM OTHER JOURNALS

Memorandum on Production of Medical Teaching Films. Scientific Film Association, 34 Soho Sq., London W1. Jan. 1947, 16 pp. mimeogr.—Part A concerns financing the production of films by university groups and B with the coordination of organizations concerned with medical teaching films. A lack of films, except in anaesthesia, is reported. Since the cost of films, especially with sound, exceeds ordinary budget possibilities it is proposed that a government grant of £I million be obtained. Subjects needed first include: embryology, cytology, pharacology, neurology, pediatrics and public health. Cost estimates for a two year plan to make these films are £57,920 (approx. $231,000). The films should be planned and done by university groups with professional aid to assure satisfactory films. Charts illustrate the proposed integration of the groups to be concerned with medical films.

Bloedorn, W. A., Markee, J. E., and R. P. Walton, Report of the Committee on Audiovisual Aids. *J. Assoc. Am. Med. Coll.,* 1947, 22:129-136.—The Inter-Departmental Committee (Navy and War Depts., U. S. Pub. Health Serv. and the Veterans Admin.) proposes to place its combined resources at the disposal of the Association and the Association of American Medical Colleges in turn will provide the personnel required to establish and maintain a Medical Film Institute. The institute will be established at a central point and will produce any film requested by a medical school, that will be acceptable to the curriculum of medical schools and the services represented by the Inter-Dept. Committee. Other films may be made. The institute would examine, analyze and catalog all medical audiovisual aids. The types of aids that would be useful in teaching medicine are listed. It is proposed to obtain an annual budget of $100,000 for a period of five years to establish the institute. Cooperation is proposed with other groups on an international scale.

Boyd, H. S. An animation method for surgical motion pictures. *Med. Rec. & Phot.,* 1947, 23(2):50-53.

Buckstone, W. Medical motion pictures. Phot. J., 1947, 87(B2):52-56.

Leonard, D. W. Medical motion pictures in private practice. *N. Eng. J. Med.,* 1947, 237(15):540-543.

Pijper, A. A motion picture of bacterial shape and motility. Wallachs' Pretoria. 1947, 8 pp.

Pijper, A. Filming as a method of research in microbiology. *Antonie v. Leeuwenhoek,* 1947, 12:26-32.

Ray, W. S. An instructional film for use in the fidelity of report experiment. J. Psychol., 1947, 24(2):293-296.

Oscar W. Richards, Chairman
Box A, Buffalo 15, N.Y.
Ralph P. Creer,
Harry E. Morton.

We Do Not Want YOU To Read This!

This is meant for the *other* fellow,—the individual who confines his BPA activities to merely *reading* the Journal.

He wonders why it is not larger, why it does not contain more articles and illustrations, or why the subject matter is not more varied. Why don't the officers do more about it?

If the Convention comes to *his* home city, or near it, he may attend. And if he does, he wonders why more fellows do not enter pictures and color slides,—enough to make what he calls a "big show". More general criticism follows, and then he goes home to cogitate again.

Little does this chap know or care that the officers serve without compensation, and very often at a personal sacrifice of time and money.

If you have read this far, and still are interested in this fellow in question, won't you tell him the Editor and his associates need and welcome his cooperation?

Tell him to write up that new gadget that he has worked out, or the new shortcut in technique he has developed. The rest of us would be glad to hear about it. When the next Convention Salon comes along, tell him to run off some of those swell prints and send them in for the rest of the members to admire. Remind him of the grand convention which is being planned for him in Philadelphia next September.

If this chap tells you he isn't an author, tell him to do his best,—I am sure that the Editorial staff will be glad to help him put it in an acceptable form. Our Journal is the greatest single factor in unifying our Association aims and activities. To keep it on its present high level, the cooperation of the entire membership is needed.

As a member, the Journal belongs to you, and is maintained to serve you.

But, the Journal is YOUR job, too!

RAY MIESS

Comparative Projection

Like two heads, two projectors may be better than one. The human mind can compare two images better when both are before the eye than when one of them is only a memory. A psychologic advantage of the printed article over the spoken address is the reader's ability to jump back and re-read a preceeding sentence in the light of a succeeding illustration and to compare illustrations or charts directly, without depending upon the fallible recollection of a hurried observation.

Two or more projectors can demonstrate side by side the gross and the microscopic appearances of a tumor, similar tumors of different grades, contrasting graphs, roentgenologic and operative appearances, facies and a temperature chart, before-and-afters or, sometimes most useful of all, a normal to which the deviation can be compared.

The principle can be extended to other applications. As one example, synchronized automatic projectors for pictures and for textual or diagrammatic explanations thereof constitute an automatic, unattended exhibit.

JOHN FALLON, M.D.

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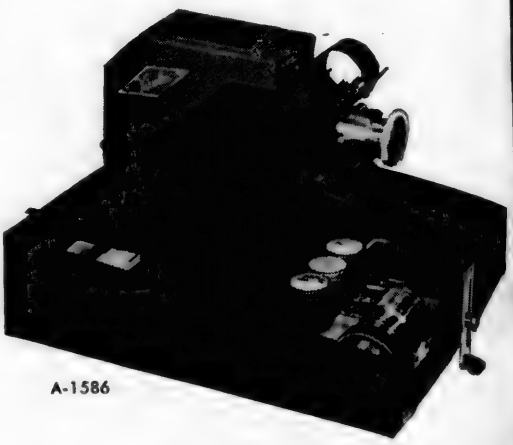

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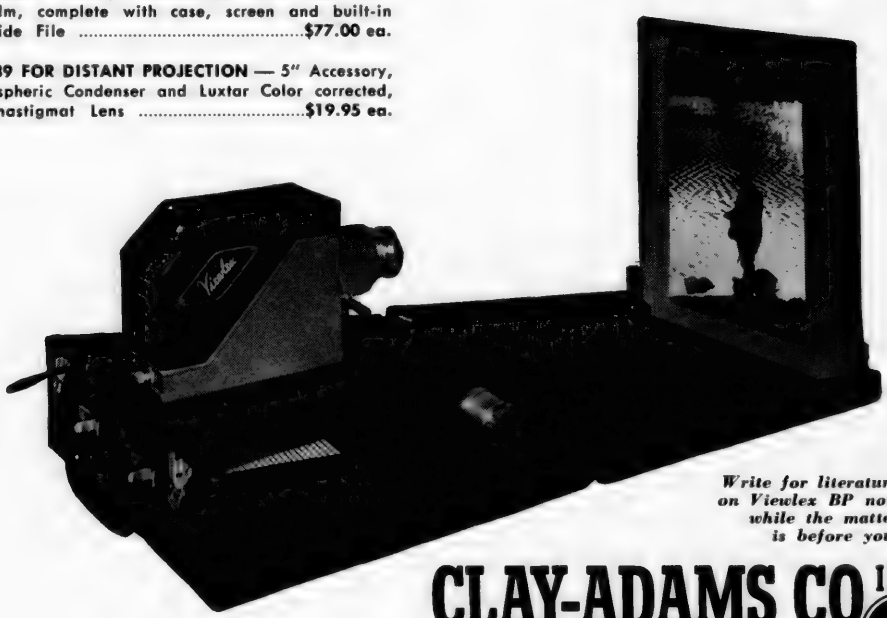

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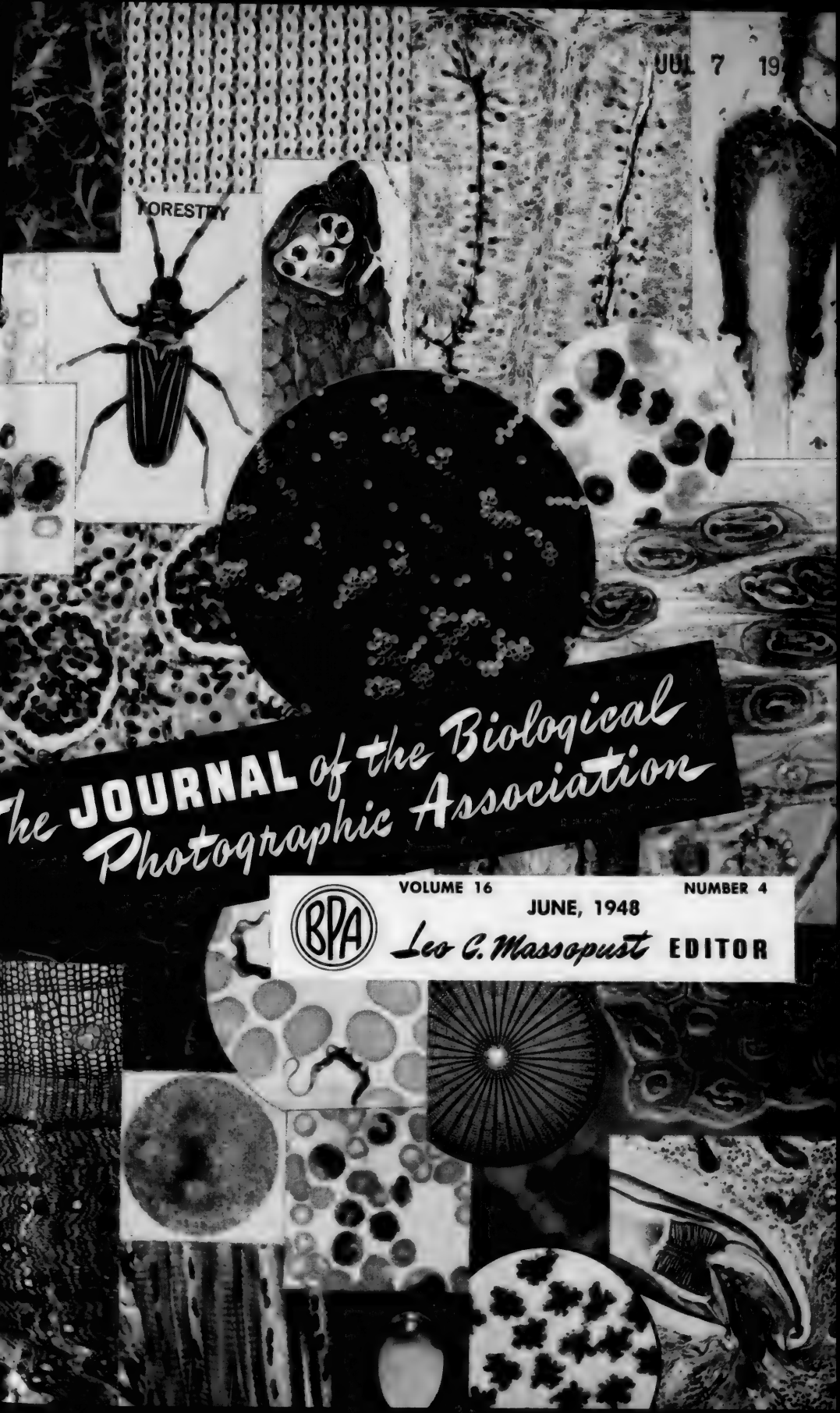

The JOURNAL of the Biological Photographic Association

VOLUME 16 NUMBER 4

JUNE, 1948

BPA

Leo C. Massopust EDITOR

BPA Convention

The 1948 Meeting of the Association, by invitation of the University of Pennsylvania, will be held in Houston Hall on the Campus of the University in Philadelphia, Pa. on Wednesday, September 8, Thursday, September 9, and Friday, September 10.

Dr. Harry E. Morton of the University of Pennsylvania School of Medicine is the Convention Chairman, Harold C. Baitz of The Wistar Institute is in charge of the Program, Basil B. Varian of the University of Pennsylvania School of Medicine is in charge of the Scientific Exhibits and Salon, and William J. Taylor of Temple Hospital, 3401 N. Broad Street, Philadelphia 40, Pa. is in charge of Commercial Exhibits.

PROGRAM

The Program of the Convention provides for presentation of papers from the platform, motion pictures, a smoker, time to view the exhibits, business meetings, a luncheon with speaker, an Eastman Kodak Co. cocktail party, and an Annual Award Dinner with speaker.

SYMPOSIA

As an innovation, organized symposia and demonstrations are planned. Two or three groups, each discussing a phase of biological photography, and having a discussion leader, can be in action at the same time. Members may attend the group or groups of their choice.

Some suggestions as to topics of discussion and discussion leaders have been received, and more will be welcomed. Subjects under consideration are: Photomicrography, Demonstration of Clinical Photography, Photography of Small Areas, Motion Pictures, Lantern Slides and Copying, Darkroom Layout, and Administration Problems.

Requests to include other aspects of biological photography, recommendations as to choice of a discussion leader for any subject, and offers to conduct or contribute to a discussion or demonstration should be sent to the Program Chairman before July 1, 1948.

ABSTRACTS

Members planning to present a paper, a demonstration, or motion pictures as part of the regular program should send the title and an abstract of 225 words or less to reach the Program Committee before July 1, 1948. The time required for presentation should be specified. If lantern slides or motion pictures are to be shown, please state size and whether color or black-and-white. For motion pictures safety film

(Continued on Page 184)

The JOURNAL of the Biological Photographic Association

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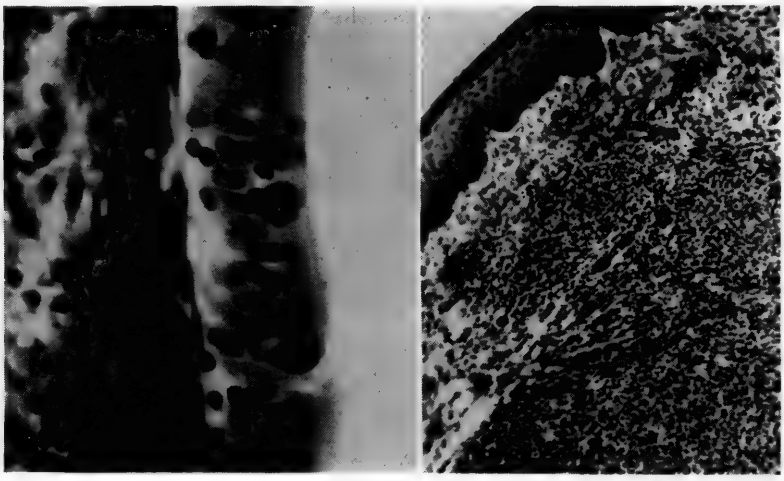

Figure 4. Jejenum, rabbit — x490 and enlarged x4. Thionin stain, no counter stain. Polaroid lens (at B) and yellow filter. Freezing technique, sectioned at 15 micra.

Figure 5. Tonsil, human — x160 enlarged x4. Gallocyanin, no counter stain. Polaroid lens (at B) and yellow filter. Paraffin technique, sectioned at 12 micra.

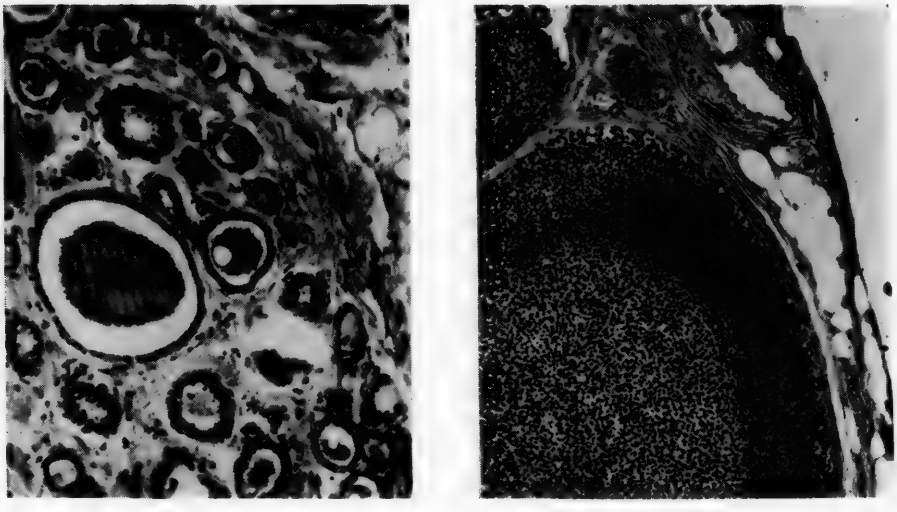

Figure 6. Thyroid, rat — x160 and enlarged x4. Hematoxylin and eosin. Polaroid lens (at B) and yellow filter. Paraffin technique, sectioned at 12 micra.

Figure 7. Lymph node, human — x160 and enlarged x4. Gallocyanin and counter stained with eosin. Polaroid lens (at B) and yellow filter. Frozen technique, sectioned at 10 micra.

Polarized Light In Photo-Microscopy

W. V. Cole*

POLARIZED light has been used in a number of procedures for the detection and identification of cellular crystalline substances and lipoid materials. In many instances, polarized light is advantageous in demonstrating the cross striations of somatic muscle fibers and cellular inclusions, especially after staining with azure eosin (1). Anisotrophic substances are demonstrated easily with this kind of illumination.

In most techniques the necessary microscopic equipment is highly specialized as compared to the compound microscope used in conventional microscopy. The polarizing microscope contains crossed Nicol prisms in the optical system which are expensive, and because their use is somewhat circumscribed are not included in equipment of histological laboratories (2).

It would seem useful to devise a technique for the use of polaroid lenses which would not be costly and yet would improve nuclear detail in photomicrography. This report describes such a method.

Materials and Methods.

Polarization of the light source was accomplished by the use of 'polaroid lenses'[1]. One of the lenses was put into the light source and the other on the eyepiece of the microscope. (See figure 1.)

The use of such lenses in the optical system reduces the intensity of the light and it was therefore necessary to find a source of steady brilliant light. Such a source was obtained from the carbon light of a micro-projector. The microscope was mounted in the pathway of the light and the camera placed over the microscope. (See figure 1.)

Two different cameras were used in this experiment, a *Speed Graphex* and a *Gamma, Model 1200.* The latter proved to be the most efficient. Any camera with a ground glass back is adaptable to this type of photography.

The optical system which proved to be the most efficient consisted of an apochromatic objective lens (3 mm., N.A. 0.95) and a compensating eye piece (x10). In several experiments a yellow filter was

* Received for publication May 1, 1948 from the Research Laboratory K.C.O.S., Kirksville, Mo.

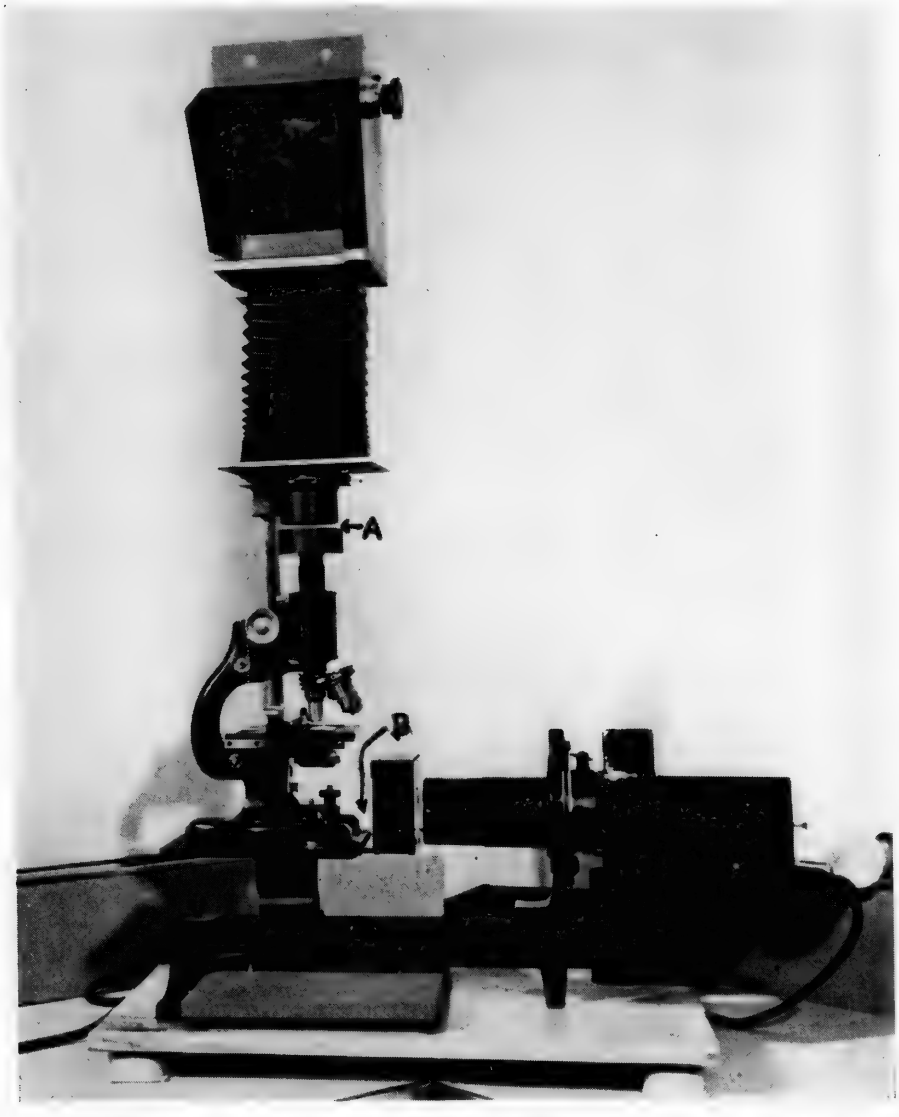

Figure 1. Photographic equipment used in the experiment. 'A' indicates the position of the polaroid lens over the eyepiece. 'B' indicates the position of the polaroid lens in the light source.

used. Either special filters or yellow cellophane can be used effectively. The film was Eastman contact process panchromatic and the paper used in printing was Defender R-2. The negatives were enlarged x4 in the printing process.

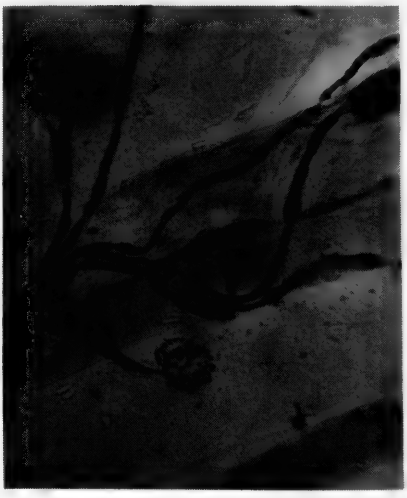

Figure 2. Motor end plate (rat). Gold chloride stain x160 without polaroid lens or yellow filter. Teased preparation.

The histological preparations photographed in this experiment were jejenum (rabbit), tonsil (human), thyroid (rat), and lymph node (human). Tissues were removed within five minutes after death by ether anesthesia, with the exception of the tonsil and lymph node which were removed at surgery and fixed immediately. The tissues were fixed in 10% formalin in .9% NaCl in distilled water, for six days before the slides were prepared.

The freezing and paraffin method of sectioning were employed, sections were cut at ten micra and stained by the spot plate method (3) and routine paraffin staining. Thionin, hematoxylin, and gallocyanin were the nuclear stains employed and eosin was the only counter stain used.

Experimental.

Experimentation was performed as described below, in an attempt to ascertain a comparable exposure for each set of conditions:

Experiment 1.

The exposure was made without polaroid lenses or the filter. Exposure was 0.3 second. Cellular detail was lacking but contrast of the cellular elements against the unstained background was good.

Experiment 2.

Exposure was made without a polaroid lens but with the filter. The exposure was 0.5 second. Contrast and cellular detail were not good.

Figure 3. Motor end plate (rat). Gold chloride stain x490 enlarged. Same section under higher magnification photographed with yellow filter and polaroid lens in light source (at 'B').

Experiment 3.

Exposure was made without the yellow filter and with both polaroid lenses at an angle of 180°. This angle emits a full complement of light in one plane without reducing the intensity of the light. Exposure was 0.6 second. The cellular detail was not improved to a great extent but the contrast was increased.

Experiment 4.

Exposure was made with the polaroid lenses at an angle of 135° and the filter was not used. Exposure was 0.5 second. The results of this experiment was similar to that of the preceding experiment.

Experiment 5.

Exposure was made with the yellow filter and a polaroid lens inserted in the light source. (See figure 1 # B) Exposure time was 0.5 second. The cellular detail and contrast were preserved best under these conditions.

Results.

It was observed in routine microscopy that the use of the polarizing lenses did not appreciably aid in visual observation, either on the ground glass screen on the camera or through the microscope.

The results of this experiment indicate that the system described in experiment five is advantageous when photomicrographs are desired, as cellular detail is preserved.

The type of histological methods used in the preparation of the slides did not seem to influence the photographic technique . (See figures 2-7 for examples of the results of this experiment.)

References

[1] Lillie, R. D. *Histopathologic Technique.* The Blakiston Co., Philadelphia, Pa., p. 9.
[2] Munoz, F and Charipper, H. 1943. *The Microscope and its use.* The Chemical Publishing Co., Brooklyn, N. Y., pp. 201-205.
[3] Cole, W. V. 1947. "Quick Staining Method for Frozen Sections," *Stain Technol.* 22:5-7.
[1] Lenses of this type may be obtained from the General Biological Supply House, Chicago, Ill.

Improvement of Illustration Value of Prints

Stanley J. McComb*

ONE of the aims of the Biological Photographic Association is to report on new and improved photographic technics applicable to the biologic sciences. Frequently, these reports deal with entirely new technics; at other times they deal with the extension of known methods to a new area. The present paper is an attempt to direct attention to possible improvement in routine methods; in effect, to examine the "modus operandi" with a view to improving what I have chosen to call the illustration value of biologic illustrative material.

There are many factors which influence illustration value in addition to the technical requirements for good negative and print quality. In taking the photograph, position of the camera, lighting, backgrounds, suitable emulsion and the depth of focus must be considered; in the finishing of the print there can be hand work on negative or print, such as opaquing, shading in printing or chemical reduction—trifling things, some of them, yet very effective in improving illustration value.

In clinical photography of patients, definite positions of the subjects are often indicated. Typical are anterior, posterior and lateral views. There are cases in which these standard views do not depict the subject to best advantage, when the best representation would be achieved by some other position of the subject. If comparison views are desired, such as preoperative and postoperative views, the size of the image is of paramount importance. All photographic records of patients should be in a definite ratio of size of image to the original, as ¼ size, ½ size, ¾ size and so forth. For strict comparison, position, height and angle of the camera should be identical throughout the series. Even the tilt of the head and the focus of the eyes of the subject play an important part in securing identical views (figures 1*a* and *b*).

The basic factor in any photographic process is light—the kind of light and the direction it takes in relation to the object before the camera. In clinical photography it has become almost axiomatic that a broad flat lighting be used. A practical lighting arrangement consists of two

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Figure 1a and b. Completely dissimilar views of the same subject, obviously of little value for purposes of comparison. Differences are due to change of lighting, camera angle and height.

lighting units, one close to the camera and about level with it, the second unit on the opposite side of the camera at a 35 to 40 degree angle to the subject-camera axis and higher than the first unit. While such an arrangement is satisfactory for many subjects, strongly directional lighting is essential to portray adequately some conditions. Figure 2*a* shows the effect of a broad front light on a defect of the cheek. The scarring but not the depth of the scar is shown. Figure 2*b*, a photograph made with directional lighting, records everything about the subject. As a result, the illustrative worth of the print is increased.

Flash photography of clinical subjects is practically always done with the flash reflector held above the camera lens and very slightly to one side to obtain some relief or shadow pattern. Directional lighting is not successful, from a reproduction standpoint, with one light of any kind unless a light reflector of cardboard or cloth is used as a fill-in on the shadowed side to prevent the shadows from being too dark. When lighting is considered, attention must be given to the difference in

Figure 2a. Routine broad front lighting of patient with defect of cheek. b, Directional lighting of the subject is far more revealing as to the character of the defect. The shadowed foreface may be made lighter by shading in printing. See figure 8.

quality between mazda light and flashlight. Flashlighting, all other factors being the same, tends to soften contrasts, which is desirable on occasion. Flashlight penetrates cavities and illuminates them far better than does mazda light (figure 3). Conversely, such softening is detrimental in conditions in which it is necessary to show contrast in adjacent areas, as in skin lesions, in which case mazda lighting, with or without a filter, may be used.

Figure 4*a* and *b* illustrates the potentialities of lighting. Figure 4*a* shows a culture plate on a black background lighted from above and to the side of the dish. Rephotographing with different light-

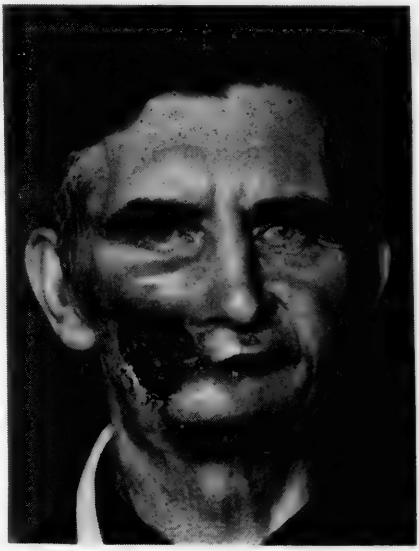

Figure 3. Flashlight, by its very abundance, exerts a softening effect and makes possible the recording of greater detail than is possible with mazda light. It is of particular value in photography of cavities.

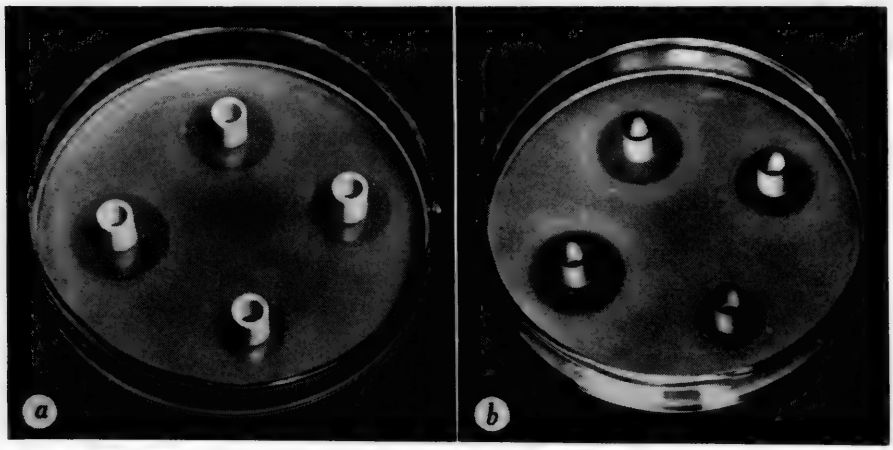

Figure 4. The object here was to show the rings around the tubes on the culture plate. a. Appearance when plate is on black cardboard with light near side of camera. b. Culture plate rephotographed after it had been placed on a sheet of glass 30 cm. above the same background as in a and illuminated from below and to the side.

ing resulted in the more acceptable photograph shown in figure 4*b*, in which the plate was supported on a sheet of glass 10 to 12 inches (25 to 30 cm.) above the background, and was lighted from below and to the side; note how much better the small clear areas around the tubes are shown.

Biologic photography embraces such a wide field of subject material that it is imperative to become familiar with the characteristics of different emulsions available and to use suitable ones as occasion demands. The effect of proper choice of emulsion on reproduction value is shown

Figure 5a. Routine use of a panchromatic emulsion for unfixed specimens resulted in this unsatisfactory photograph of a thrombus of the pulmonary valve. No filter was used. b. Same subject as in a with same lighting photographed on a long scale orthochromatic emulsion, again without a filter.

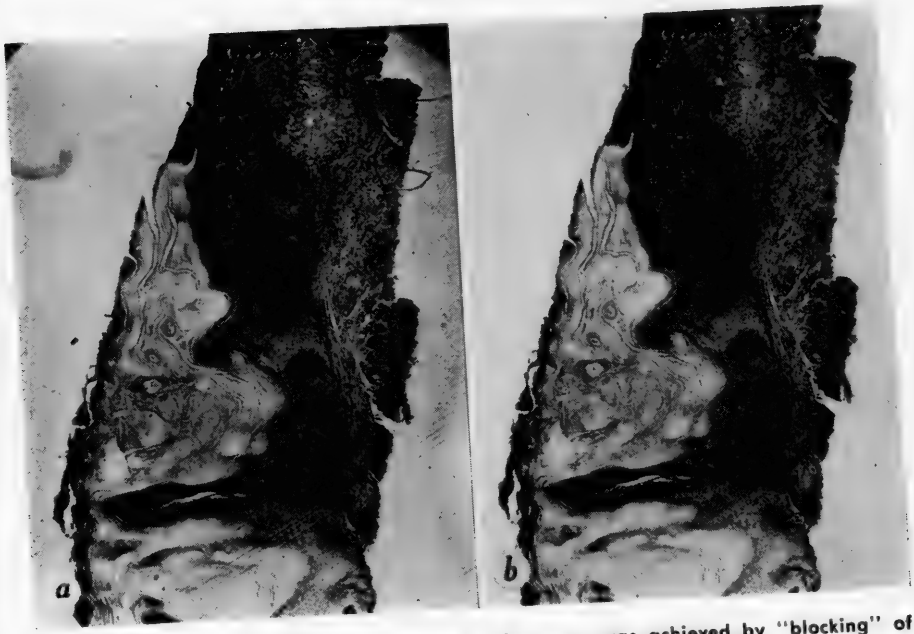

Figure 6a and b. Improved appearance of b over a was achieved by "blocking" of the negative, that is, by covering areas intended as white with an opaque medium. Careful work on the print with Farmer's reducer would give the same effect.

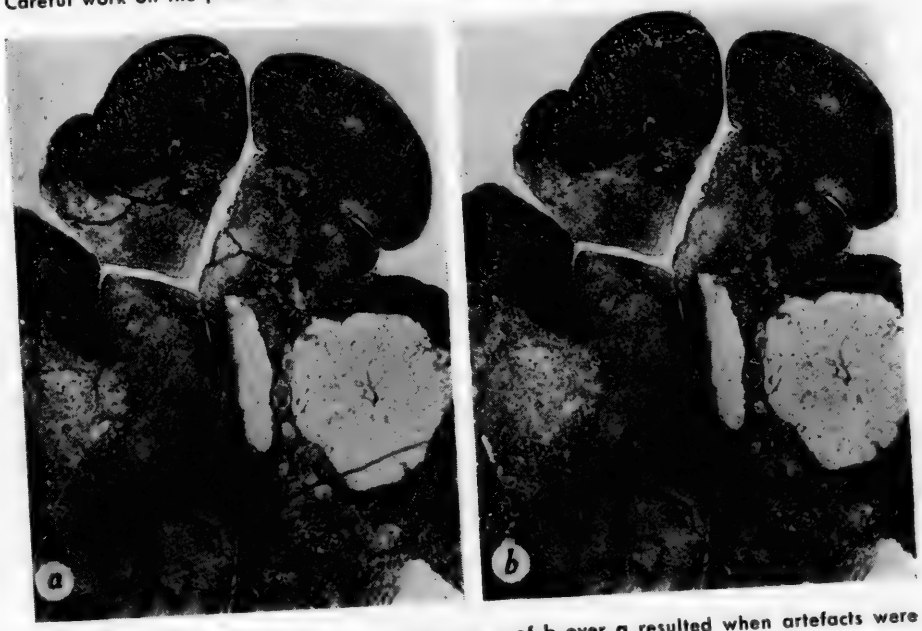

Figure 7a and b. The improved appearance of b over a resulted when artefacts were removed by spotting and retouching of the negative.

in figure 5*a* and *b*. Photography of operative and unfixed specimens suggests panchromatic emulsions, yet in this instance visualization of the small thrombus on the leaflet of the pulmonary valve was minimized by use of such an emulsion, a condition which was corrected by the use of a long scale orthochromatic film. Personal experience suggests a wide range of usefulness for orthochromatic emulsions, with constant alertness for the use of other emulsions as conditions require. For example, an orthochromatic film with a contrast filter might be suitable for a low power photomicrograph of a stained histologic section while an oil immersion view of the same section would require a panchromatic emulsion with quite different filtering.

In the finishing of the print there are several methods of improving illustration value which involve handwork on the negative or the print. Blocking, retouching, etching and spotting of the negative are all legitimate means of improving the appearance of a print, providing the basic picture is unaltered. Use of an opaque medium (dye or pigment) in blocking out portions of a negative is recommended for eliminating unwanted backgrounds or as a means of obtaining a white background. Occasionally, the chemical action of Farmer's reducer (see any photographic handbook) may be used effectively to alter print con-

Figure 8. Foreface brought into better tonal balance by shading of the negative in printing. A more pleasing illustration results.

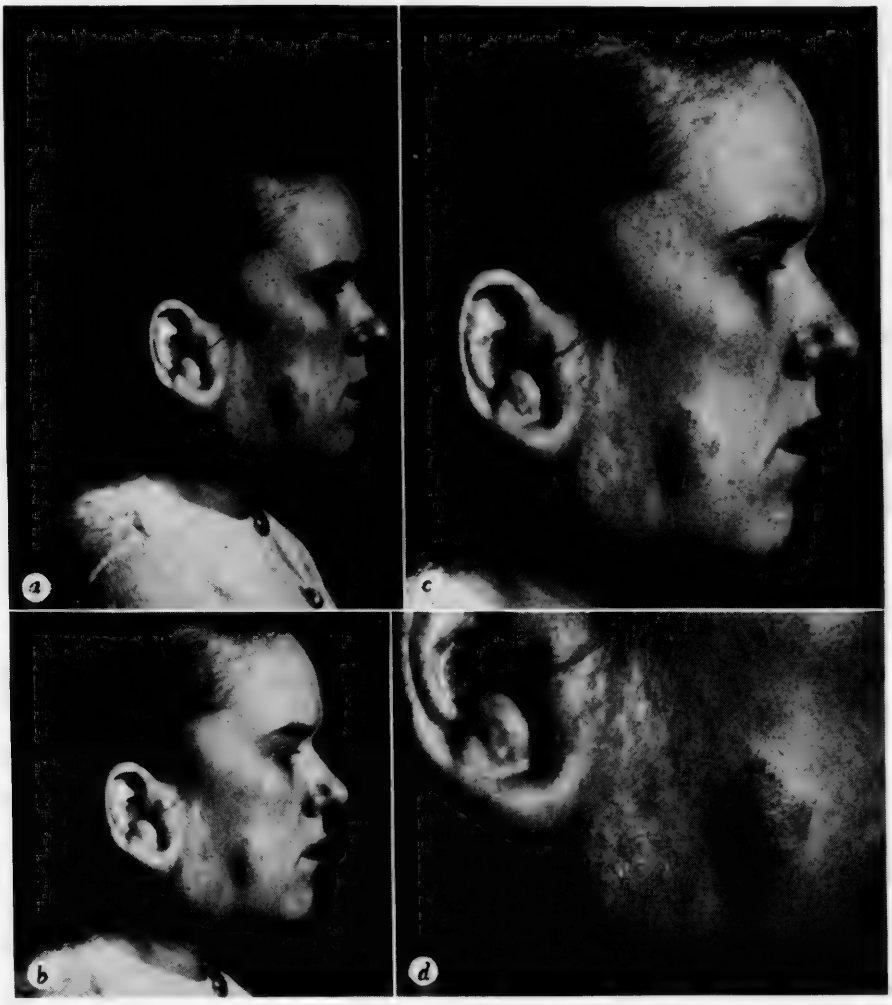

Figure 9. Different ways of using negative material. a. Print from entire negative. b. Printed cropped to include just the face. c. An enlarged print still shows most of the face. d. An enlarged print to show only the lesion.

trast, to add highlights or simply to clear areas as shown in figure 6. I am indebted to Mr. Leonard Julin for the material used in this figure as well as for that used in figure 7.

Artefacts are commonly found in low-power photomicrographs. When it is known that such a photograph is intended for publication, a much more presentable illustration results if the artefacts are removed by spotting and retouching (figure 7).

In printing it is sometimes desirable to retard the action of light through certain areas of the negative. This may be done by the use of dodging dye applied to the thin areas of the negative or by the use of various bits of tissue paper or other similar semitransparent material placed on a sheet of glass below the negative and between it and the source of light. In enlarging, such retardation is accomplished by the interposition of a hand, cardboard or dodging disk between the enlarger and the paper. Any standard photographic text contains suggestions for either procedure. Figure 8 demonstrates the improvement possible by this means.

A final suggestion for improving the illustration value of prints relates to trimming. The beneficial cropping of prints is all too frequently overlooked, yet this in itself can effect a great improvement in the result. Figure 9 illustrates four different ways of submitting prints from the same negative. While individual circumstances dictate procedure, in general it may be stated that illustrative material is far more effective if restricted to the point of interest.

In conclusion, an attempt has been made to indicate many small variations in routine technic which aid in securing photographs of higher quality with improved illustration value. Constant alertness to all conditions and a willingness to experiment is a necessary part of the pattern for producing better photographs.

The Preparation of Patients for Photography

Albert Sadler*

A PROTEST against the unshaven faces that are photographed in the name of medical photography prompted this paper, but it was soon considered advisable to discuss matters pertaining to the preparation of patients for photography. The direct approach used here is believed to be best suited to the subject.

A photograph should be as good as one can make it. This applies not only to technical quality and photographic excellence, but to details concerning the preparation of the patient. Quite often, the value of an otherwise good clinical photograph is depreciated by carelessness regarding such details. Sometimes poor preparedness of the patient results in a ruined picture.

In looking over medical illustrations in the literature, one sometimes feels that a picture could have been improved. Here are some remarks and suggestions.

First of all, before we consider separate items, there is a matter that requires emphasis: no patient should be photographed without his *written* and *witnessed* consent. If he is not socially competent, is a minor, or is unconscious, the written, witnessed permission of the guardian or next of kin is required. This rule applies to any photograph involving any part of the person, even though it is not identifiable with him. To photograph a patient without consent is an invasion of privacy, and he may recover damages on such grounds. The permit should be obtained before the photograph is taken. A verbal consent is not sufficient since a person may later deny having given it and make a nuisance of the matter for personal gain. A release is difficult to obtain after the picture has been made.

In this institution, the permit is printed in the form of a release on the reverse side of the photographic requisition card. It reads as follows:

RELEASE

WAYNE COUNTY GENERAL HOSPITAL AND INFIRMARY

I hereby give permission to the authorities of Wayne County Gen-

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eral Hospital and Infirmary to photograph my body or parts of my body for scientific purposes. I also give permission to the said hospital authorities to copyright, use, exhibit and publish reproductions from all photographic material of me in the hospital.

This release includes still and motion pictures, and color photography.

Signature:_____

Witness:_____

Date:_____

The following points should be observed before the patient is photographed.

Attire:

No clothing of any kind should appear in the picture. Hospital gowns or pajamas should be removed; also socks, shoes or slippers. Outpatients should undress as required. A good rule to follow is: for face, head, or neck, strip the patient to the waist or sometimes, in the case of women patients, drape just above the breasts. For thorax and abdomen, all the clothing should be removed, but the pubic region may be draped if it is not essential to the picture. For full length views, no drapes, loin cloths, socks or slippers, but a blind fold may be used.

In all photographs showing the face, the eyes may be blocked out on the print if such blocking does not obscure a lesion. When drapes are used they should not appear in the print.

Dressings:

Dressings should, of course, be removed. Bits of lint adhering to the lesion should be picked off with forceps. The tape marks on the skin may be removed easily with ether. It is preferable to have the nurse of doctor on the ward remove the dressing, clean the site, and apply a loose dressing for the trip to the studio.

If the photograph has to be taken on the ward, one should make an appointment to be there at the time dressings are changed. Have soiled sheets and/or draw sheets replaced.

It should not be the duty of the photographer to remove and replace dressings. This function lies within the province of the nurse or attendant who accompanies the patient to the studio. However, a few instruments such as scissors, forceps, and clamps should be kept in the studio along with sterile gauze, bandages, and gloves. The instruments may be either changed after use or bathed in Lysol solution and dried.

Tonsorial:

The most common objection to a clinical photograph which includes the face is that the subject was not clean shaven. There is generally no excuse for this. One should make it a standing order that male patients be shaved before they are sent to the studio and a hair cut be given when necessary. Even a day old stubble should not be tolerated; the photographer would do well to send unshaven patients back without taking a photograph.

Cleanliness of the skin is usually taken for granted, but sometimes a new patient is deficient in this respect. Dirty hands and feet in particular, and body surfaces in general are not uncommon, neither are food stains and dried exudate. When indicated, a wash or bath should be given before the patient is sent to the studio.

Cosmetics and Accessories:

One should remove necklaces, neck chains, earrings, hair combs, bracelets, rings (if possible), lipstick, face powder, rouge, finger and toe nail polish. These items seriously detract from the value of a clinical photograph.

In addition to the foregoing details, there are a few other important points.

Attendant:

Always have a nurse or hospital attendant (orderly), of the same sex as the patient, present. The legal reasons for this are obvious. The nurse or attendant should prepare the patient by removing clothing and dressings. Quite often, it is necessary to have eyes, mouth, or genitalia better exposed; this should be done by the attendant or assistant under direction of the photographer. However, if the patient can cooperate, it is sometimes advisable to let him do so.

A set of instruments for obtaining exposure of the oral cavity should be kept on hand. These instruments have been fully described by Payne[1]. In addition, a speculum may be needed for exposure of the cervix uteri; however, this instrument should be used only by a doctor and the photograph of a cervical lesion should preferably be taken in the gynecologic examination room or operating theater.

Immobilizers:

Any movement on the part of the patient will spoil the picture, since most exposures are made at ½ second. The use of single or multiple flash will ensure stopping of motion, but this method is not always

desirable. For regions of the head, the use of a head rest is essential. This rest is clamped to the top of a straight-back chair. An Eye, Ear, Nose and Throat examination chair is equally practical. Particularly for close up work such as the photography of the oral cavity, eyes, and ears, such immobilization of the head afforded by a rest will be found absolutely requisite.

Feet (and legs), and hands (and arms) may be immobilized by placing the member on a large piece of ¾ inch plywood (with background interposed). Motion of the chest and abdomen due to breathing can be stopped for a second or two by the simple expedient of having the patient hold his breath.

A full length photograph of a patient who cannot stand may be easily obtained by placing him on a sheet and mattress on the floor. The camera tripod can be placed on the top of a table close to, and at a right angle to the subject. Better still, construct a scaffold. For bedridden patients, a stretcher with removable top will allow easy placement of the patient on the floor.

An examining table with leg supports and drop end is required in the studio for the proper exposure of genitalia and adjacent regions, particularly those of female patients.

Backgrounds:

The choice of background is very important and should be made by the photographer (not the doctor). To show height, reach, or nutrition, one may use a wall or framed ¼ inch plywood about 7 feet high and 9 feet wide. It should be painted a flat, light blue or light green, so that it may be used for color as well as black and white photography. Markers, one every foot, six high and seven wide should be placed in the form of a T, preferably painted in flat black. Black grounds are not desirable for full length photography.

One background is not enough. About four are needed: one as described above, one of the same size but without markers, one about four feet six inches wide and seven feet high painted flat white, and one the same size painted flat grey. These framed plywood grounds should be painted on both sides. "Window-shade" canvas grounds are useful, but the author feels that there is an advantage in movable grounds. The 7 x 9 feet plywood board previously mentioned is the most useful, since it is ideal for both still and motion picture photography.

For small size backgrounds, one uses cards 28 by 44 inches in white, grey, black and colors (blue and green, etc.). These cards may be used as grounds for the head and, with a ¾ inch plywood board, may be

placed between the patient and the back of the chair to form a ground for the torso.

In the opinion of the author, color backgrounds should not have texture and plain colored cards are superior to cloth, but for those who prefer a ground with detail he recommends the use of spun rayon. This material (used for making ladies' dresses) comes in several colors, is one yard wide, washes well and does not show creases. It costs $1.00 per yard.

It may best be used by tacking it to ¾ inch wooden frames of a size large enough for photographs of the head, hands, and feet. Also, for subjects which are not dry (leg ulcers, hand lesions and gross specimens), it may be placed under a sheet of glass.

Duplication:

Many cases are photographed more than once. Interval photographs to show progression or regression should match for both pose and scale. While the enlarger will effect exactly equal sizes of the subject, it should not be the total answer. Many workers use large film and make contact prints. Therefore, one should standardize his technique: e.g., a scale of ½ for head, face, hands, and feet. In other poses, the reduction fraction should be noted on the requisition.

It is a simple matter to mark the camera bed with a scale of reduction. The Eastman Clinical Camera is so marked. It is also useful to mark the camera bed in inches. One should consult the previous requisition for the number of poses and scale of reduction.

General:

The cooperation of the patient is very important. Good cooperation makes for better pictures. Lack of cooperation increases the technical difficulties and may spoil the photograph. It is important that the photographer be able to understand and control the patient; a certain degree of psychology is just as essential as it is in portraiture.

In charity hospitals, patients tend to think the photographer is a doctor, and even non-charity patients sometimes fall into this error, particularly when the photographer wears a white uniform or white laboratory coat. Let the patient retain his illusions it will ensure a greater degree of cooperation and will, in the case of female subjects, allow the patient to expose her person without demur. This is not false pretense on the part of the photographer, but common sense. However, do not deliberately give the patient that impression, either by expression or implication.

Often a patient will ask questions about his condition. Do not give any direct information but instead reassure him; mention other cases far worse than his, and make him feel that he is relatively well. Answer questions regarding the use of the photographs simply and straightforwardly but refuse any request for a print. Good reasons for photography of any case are for teaching, for the files and, above all, because *his* case is unusual and of great interest to the medical staff.

Usually the doctor cannot come to the studio with a patient to give special instructions. It is a good idea for the photographer to make ward visits with the medical or surgical director to go over those cases for photography where special instructions are necessary; and ward visits are valuable from time to time on routine cases, in that a more cordial relationship between photographer and staff is developed than would otherwise prevail.

Generally, the experienced clinical photographer should need no instructions other than those on the requisition, and he should be able to work without medical supervision. He should have a working knowledge of anatomic and diagnostic terminology. He should *not* be just a mechanic behind a camera.

We, as medical photographers, should be specialists and know something about clinical and gross pathology, about anatomy and histology. The acquisition of such knowledge is not limited to doctors and a good photographer certainly has the mental ability to learn, just as some doctors have taken the trouble to learn something about photography.

References

[1] Payne, W. F.: Photography of the Oral Cavity. Jour. Biol. Phot. Assn., *15*: (3) pp. 120-130, March, 1947.

A Graflex Back for the Filmpack Camera

Michael Michael*

THE construction of this Graflex Back is for the 9 x 12 Cm. Voigtlander Bergheil filmpack camera. Some of the dimensions might have to be altered to suit each individual camera. The same procedure can also be used in converting the 6 x 9 cm. camera. On this converted camera, the 3¼ x 4¼ inch Graflex holders are used, while on the 6 x 9 cm. camera, the 2¼ x 3¼ inch holders should be used. Before building such a back, look at a Graflex camera to see how it is constructed.

First, the metal eye level finder is removed, including the strap handle on top of the camera. The ground glass back of the camera is entirely removed. Then, a piece of mahogany wood is cut and sandpapered to 6 x 4½ x ⅜ inches. This wood is the same size in width and length as the body of the camera. An opening in this wood was cut to 3⅜ x 4¼ inches.

A recess is cut 1/" deep and 7/16" wide as in figure 1. This is made so that the Graflex holders will sit flat. The wood is then placed against the back of the camera and held in place by two brass flat-head machine screws: size No. 2-56, ½ inch long. Make sure that the edge of the wood is placed evenly with the side of the camera body. Use a No. 50 drill bit to make the two holes and thread these holes in the camera body with a No. 2-56 screw tap.

Take another piece of ⅜ inch thick mahogany wood and cut it to 2½ x 6 inches. This is the same size as the left side of the camera, but ¼ inch has been added to its width. This piece of wood is placed on the left side of the camera and it is screwed in place so that ¼ inch of the width of this wood extends beyond the 6 x 4½ x ⅜ inch wood.

Use a No. 50 drill bit and thread with a No. 2-56 tap. Drill through the wood and tap the holes in the camera body. Be careful not to drill holes in the bellows. Use No. 2-56 flat-head machine screws ½ inch long. Cut a right angle corner from the 2½ x 6 inch wood, so that the corner is evenly flat with the 7/16 inch wide x 1/16 inch deep recess in the 6 x 4½ x ⅜ inch wood.

* Received for publication March, 1948, 3449 Grenshaw St., Chicago 24, Illinois.

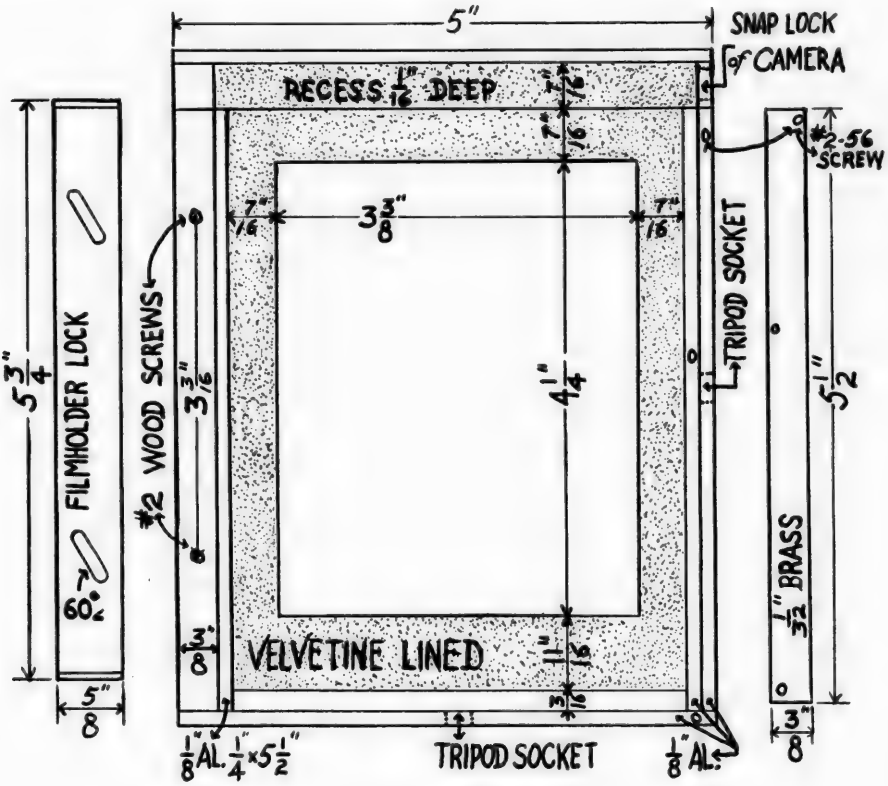

FIGURE 1

For the right side, a piece of aluminum ⅛ inch thick is cut the same size as the piece of wood on the left side of the camera and the same procedure is used. The only additional work to be done on this aluminum is to cut a hole a little larger than the knob that opens the camera bed. Hold the aluminum in place against the right side of the body of the camera with ¼ inch No. 2-56 screws. Then drill a hole for the tripod screw in this aluminum in the same position as the threaded tripod socket in the camera body. Use a No. 7 drill bit followed with a No. ¼ inch-20 size thread tap.

Another piece of ⅛ inch thick aluminum is cut to 2¼ x 5 inches and placed evenly on top of the camera body. Use No. 50 drill bit and No. 2-56 flathead machine screws to hold it in place.

For the bottom piece, ⅛ inch thick aluminum 2-7/16 x 5 inches is cut and held in place as the top piece of aluminum, and then, a

thread for the tripod screw is drilled and tapped in this metal in the same position as was the tripod socket in the camera body. All the sides are now built around the camera body.

The next step is to place strips of aluminum and one of wood along the inside of the Graflex Back so that the film holders fit smoothly in place.

From a 1/8 inch thick aluminum two strips are cut 1/4 inch wide and 5 1/2 inches long. One is placed on the inside of the right hand side of the Graflex Back and the other strip on the left side of the back. A strip of hamogany wood is cut 1/4 inch deep by 3/16 inch thick by 4 1/4 inches and is placed against the inside bottom strip of 2-7/16 inches aluminum. The strips of metal and wood are held in place by No. 2-56 flat-head machine screws.

Figure 2. Finished Graflex back.

To hold the Graflex holders in place, brass 1/32 inch thick is cut 5/8 x 5 3/4 inches and two diagonal slots are made in it as in the Graflex camera. From each end of this strip, bend the ends up so each project upwards 3/16 inches. This strip is placed on the left hand side of the camera back and two wood screws No. 2, 1/2 inch long are used to hold it in place. It should travel diagonally freely, but not too loosely.

A strip of brass 1/32 inch thick is cut to 3/8 x 5 1/2 inches long. Use three No. 2-56 round head machine screws to hold it in place on the right side of the camera back. This strip of brass should extend inward 1/8 inch.

Kodak Brushing Lacquer No. 4 Dull Black is used to blacken all metal and wood parts. Afterwards, a piece of black velvetine is cut 4 1/4 x 4 3/4 inches and cemented against the 6 x 4 1/2 x 3/8 inch wood. Then the extra cloth in the center is cut away with a scissors.

Replace the eye level finder and place a leather carrying strap on the camera. The writer eliminated these last two because he continually uses the ground glass to make lantern slides. Figure 2 is the finished Graflex Back.

The BPA Can Help Fight Cancer!

Dr. Brewster S. Miller,
Assistant Director, Professional Education Division,
American Cancer Society, Inc.

As an integral part of its program of professional education, the American Cancer Society is endeavoring to collect a series of color slides illustrating early cancer lesions. These will be made into sets and distributed to the Society's State Divisions for eventual loan to state and county medical meetings as a visual adjunct for speakers talking on cancer and its early recognition.

It has been quite difficult to obtain slides of early cancers in good color. As members of your organization are continually photographing subjects in color, I am appealing to you. If you take a color photograph of an early cancer, we should appreciate it a great deal if you would send us the original for loan for three weeks that it may be duplicated for inclusion in our sets as educational material for general practitioners all over the country. This service by you would be of immense help in the fight against cancer and in bringing to the physicians good illustrative material to which he may compare lesions of his patients.

These color photographs should be originals, preferably of the 3¼" x 4" size, and have the diagnosis and slide number clearly labeled that they may be properly acknowledged. Eastman Kodak will duplicate them in two weeks so that they will be returned to you in three weeks. Those which we cannot use will be returned to you immediately.

We solicit your cooperation, as BPA members taking the better color biological photographs in the country, and we shall appreciate anything you can do in expanding this program of education of the physician.

Practical Application of Lighting In Clinical Photography

F. R. Harding*

THE lighting of clinical patients is a subject about which many biophotographers seldom give a thought. The net result of this lack of thought is that a great many photographs are very poorly lighted. Of course many readers may disagree with what is about to be said on this subject.

First, let us look at the type of light sources that are generally in use for clinical photographs, photoflash, photo flood, high speed electronic flash equipment, 3200K lamps, either 500 or 1000 watt, and ordinary 500 or 1000 watt tungsten filament PS or T type lamps. All these lamps have certain uses in biophotography and all have certain disadvantages when used for all purposes. Let us talk about them in the order named.

Photoflash is a quick means of lighting patients. It has good usage in color photography of children, where it is essential that movement in the patient must be prevented by rapid exposure. It has been used in the operating room, although there is some danger present when it is so employed. In the author's opinion, except for specialized purposes, it should seldom or never be used for *routine* clinical photography, for it is usually the lazy man's light source when used for this purpose. It also adds considerably to the photographic cost per patient. The prime reason for this statement is that when flash is employed there is no certain knowledge of where shadows are going to fall and shadow placement is most important. Used in its worst form, as a synchronized flash attached to the camera, particularly with a short battery case, it produces a very flat light, which is rarely the best lighting for clinical purposes. Unless a time-consuming method of lighting is used first with regular lamps and then replacing them with flash lamps there is no means of being sure that the lighting will bring out the features desired in the photograph. The author uses flash for many things, but almost never on a patient. Indeed, in the commercial field, flash is frequently the only answer to a problem.

Photoflood is one of the most common sources of light for biophotography. It is inexpensive and produces large quantities of light.

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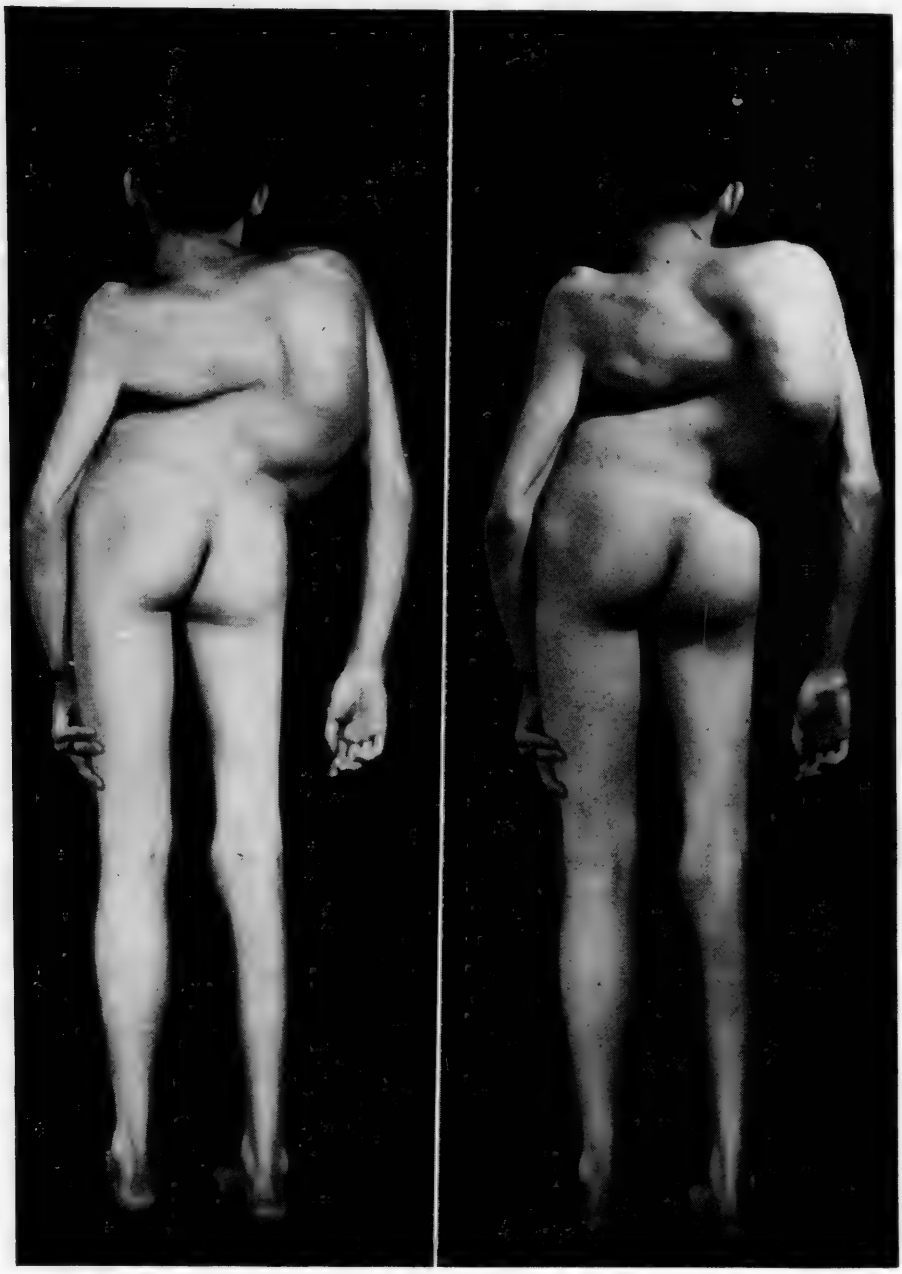

Figure 1. Left, flat lighting, right, strong side lighting, same patient.

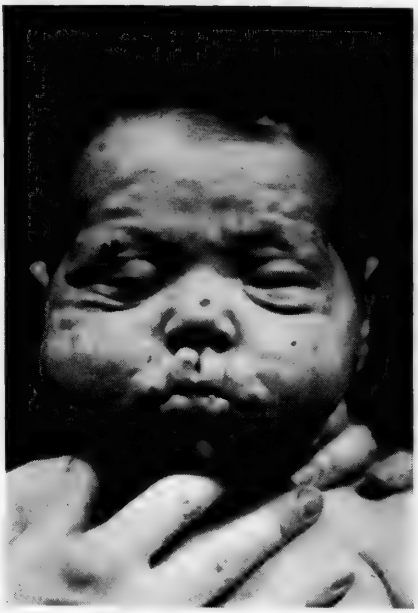

Figure 2. Urticaria. Top lighting.

It has two main failings, one of which is serious. Photoflood lamp shells are frosted, which produces a diffuse light which is admirable for nearly all purposes except photographs of pathological gross specimens and clinical patients. In these cases a hard light source rather than a diffuse one will produce the best photograph. It is difficult to throw hard shadows on slightly raised areas of skin for example, except by employing clear glass lamps. The other major difficulty with photofloods is the rather rapid blackening of the shell, which is detrimental to good color photography as it changes the color of the light. These lamps have a relatively short life which piles up costs if they are burned for very long periods of time or are in more or less constant use.

High speed flash is just beginning to be used in biophotography and it definitely has a place. It suffers from some of the things described under flash lamps, such as lack of knowing where shadows will fall, but this is offset to some extent in some tubes by having a focusing filament incorporated. The author believes it would be long range economy to use electronic flash equipment in place of flash lamps, as these tubes are good for between 5000 and 10000 flashes before tube replacement. The necessary equipment is, of course, more bulky than anything required for flashlamps, although portable types are made. Very soon it will be possible to use electronic flash for color photography and this will open some new fields for this type of equipment. It has specialized uses in biophotography, but should not be used for *routine* clinical photography.

The 3200K lamps are used for color photography with sheet color film of the Type B or artificial light type and can be used also for all black and white work. The general description of these lamps is the same as for the regular lamps whose description follows. My personal preference for a light source for nearly all biophotography is the 1000

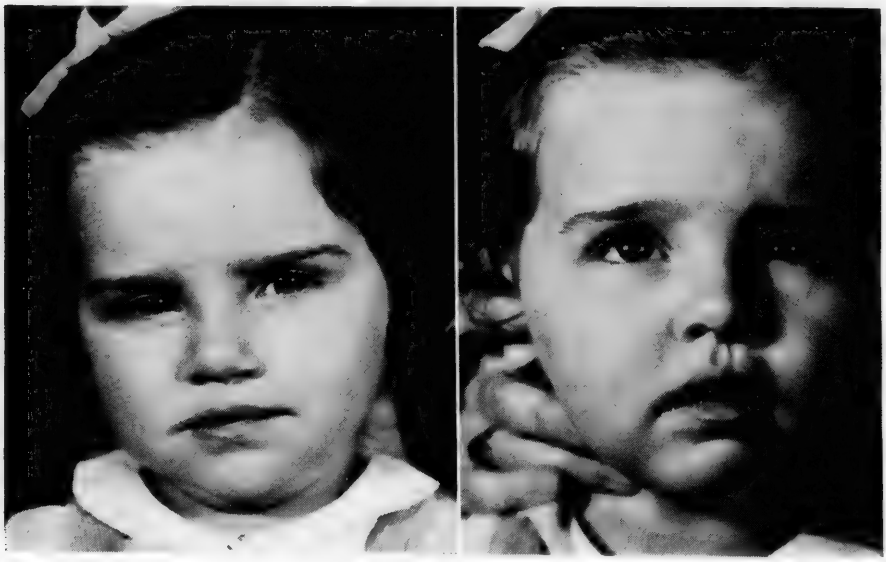

Figure 3. Defect of upper lip. Left, flat lighting, right, side lighting.

watt *clear* tungsten filament PS or T type lamp, for the following reasons. It produces a shadow with a semi-hard outline intermediate between a true spot light and the more diffuse light from a frosted shell lamp. This means that slight inequalities in skin texture can be brought out in good contrast and it produces what appears to be a more brilliant negative than other light sources. It is the author's first choice for clinical photography. These lamps have some disadvantages. They emit a large amount of heat but probably no more than photofloods, and this heat is disturbing to some patients. The reflectors required are more expensive than those frequently used for photofloods. The lamp life is long, the PS type is longer lived than the T type.

Now let us see how the lamps should be used to produce good clinical photographs. First, it is very seldom indeed that flat lighting should be used. This is the easiest lighting to use and too frequently it is the poorest choice and the only one employed. Each patient should be lighted on a basis of the individual and the diagnosis. This means that each case must be lighted to bring out the features it is desired to show photographically and this in turn means that each patient is an individual lighting problem. Every photograph made should show the surface texture of the object being photographed. Otherwise, in the author's opinion, it is not as good as it should be. In nature all shadows fall below or at one side of the object casting the shadow. In clinical

Figure 4. Urticaria. Lighted from above and to the left.

photographs it is not unusual to see shadows falling *up,* which is, to say the least, most unusual. If the lamps are kept where they should be, shadows will stay in their proper place. Evidently, from what has just been said, the light must fall *down* or from the *side,* but almost never from a position *below* the principal object. On the *average* subject, not requiring side or lateral light, the light should strike the subject at about 45° which is similar to the old Rembrant portrait lighting. This was north light striking the subject at 45° and is still hard to beat from a standpoint of modeling and texture which is exactly what the biophotographer needs. Artificial light can be made to do exactly what the old style north skylight did.

Many clinical subjects require lighting other than 45° from above. Some subjects require the primary light source to be up to 90° from the camera laterally. Even at this extreme angle the primary light should *never* be *below* the subject. A second light is used to open up the shadows. Some of the subjects requiring lateral light would be raised tumors such as spina bifida or meningocele, raised skin rashes, kyphosis, in fact anything abnormally raised above the normal body contour. All of these do not require complete lateral illumination. Some will show better with the primary light 45° lateral to the camera. Most full length, half length and head and shoulder photographs need the first mentioned

45° lighting from above. It is difficult for many individuals to change their methods of lighting but the author believes the clinical work turned out by many of us would be improved if we would try out some of the uses of light that have been mentioned. If we would experiment with different combinations of primary and secondary lights and remember when to use them, we could consistently improve the quality of our photographs. The answer to good lighting is constant experimentation. Every time a patient is photographed the lighting should be studied. The primary and secondary light SHOULD BE moved around, raised and lowered until the lighting best demonstrates whatever is to be emphasized. At first this will take time, but after a little practice it will be found that very little extra time is involved. First move the primary light, and when the best position is found, move the secondary light to lighten the heavy shadows. When placing the secondary light, fill the shadow until it is a little lighter than you want it to appear in the print. The film emulsion will increase the contrast to some extent over your visual observation. A little experience will show how much to lighten the shadows.

In the author's opinion correct lighting is of the greatest importance, next comes the proper choice of a film emulsion, and bringing up in the rear rank is the camera. Within reasonable limits, given correct lighting and the proper film, any camera will do a good job if it has an anastigmatic lens and is light tight, but the finest camera in the world will not produce a good photograph if the first two factors are wrong.

Standardization of Medical Photography

All who are interested in standardization of medical photography should read the article "Can Standardization Be Applied to Medical Photography?" by T. A. Longmore, Hon. F.S.R. (Associate), given before the Medical Group of the Royal Photographic Society in London in February, 1947 and published in the R.P.S. Photographic Journal, Section B (Scientific and Technical Photography), Vol. 88B, No. 2, March-April, 1948. Points for consideration are introduced in the following chronological order: (1) Nomenclature. (2) Picture size and shape. (3) Scale of image to original. (4) Illumination. (5) Sensitive material and filters. (6) Positioning of Patient. (7) Negative Processing. (8) After-treatment of negative. (9) Printing of black and white. (10) Color reproductions.

THE SECOND INTERNATIONAL COMPETITION OF PHOTOGRAPHY IN SCIENCE will be shown at the Natural History Building, U. S. National Museum in Washington, D. C., during the first three weeks in September. This exhibit is sponsored by the Smithsonian Institute and the Scientific Monthly. Black and white prints, color prints and transparencies will be accepted. All scientists everywhere are eligible to send pictures. The greatest weight will be given to pictures that show originality of technique and novelty of application of photography to scientific research. The closing date for entries is August 16. Entry blanks may be obtained from the Editor, The Scientific Monthly, 1515 Massachusetts Ave., N.W., Washington 5, D. C.

NOTICE TO BPA MEMBERS VISITING THE MEETING OF THE AMERICAN MEDICAL ASSOCIATION, JUNE 21-25, CHICAGO: The Chicago Chapter has reserved a dining-room at Abbott Hall, the Social Center of Northwestern University College of Medicine, on June 22, at 6 P.M. so that all who care to can meet for dinner. Abbott Hall is only a few blocks from the Navy Pier where the A.M.A. exhibits will be held. For further information go to the BPA booth, S-215 in the A.M.A. Scientific Exhibit.

BPA Officers and Committee Chairmen

President	Edmond J. Farris, Ph.D. The Wistar Institute Philadelphia 4, Pa.
Vice President	Oscar W. Richards, Ph.D. American Optical Company Scientific Instrument Div. Buffalo 15, N.Y.
Secretary	Anne Shiras University Office Magee Hospital Pittsburgh 13, Pa.
Treasurer	Stella Zimmer Photographic Department School of Medicine Syracuse University Syracuse 10, N.Y.
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Public Relations Committee	Dr. Arthur W. Proetz 12 Westmoreland Place St. Louis 8, Missouri
Annual Salon	Nathan S. Horton 485 McGill Street Montreal, Canada
Questionnaire Chairman	Arthur L. Smith Photographic Science Service Cornell University Ithaca, N.Y.
Committee on Fellowships	Dr. Arthur W. Proetz 12 Westmoreland Place St. Louis 8, Missouri
Committee on Grants	C. Graham Eddy Veterans Administration Washington 25, D.C.
1948 Convention Chairman	Dr. Harry E Morton School of Medicine University of Pennsylvania Philadelphia 4, Pa.
A.M.A. Exhibit Chairman	Stanley J. McComb Section of Photography Mayo Clinic Rochester, Minnesota

Association News

B.P.A. FACTS AND FIGURES. 21% of our members are in New York State. As Pennsylvania has 8% of the members, and Massachusetts 3%, it will be seen that 32% are in these three eastern states alone. 9% are in Illinois; 8% in California and 6% in Ohio. There are still five states in which we have no members.

Full-time professional photographers in medicine or dentistry comprise 30% of our members. Another 4% are full-time professional photographers in other sciences (biology, botany, etc.), 10% work part-time in medical or biological photography, with other work or other types of photography taking up the rest of their time. Scientists in the medical, public health or dental fields make up 30% of our memberships. Another 15% are scientists in other fields such as biology, agronomy, entomology, etc. The remaining 11% are manufacturers, dealers, experts in crime detection, research workers in commercial firms, amateurs and students.

These figures do not vary widely from those published last year (Vol. 15, No. 4, June 1947, p. 203). We have a smaller percentage of full-time professional medical photographers than we had then; and we have gained full-time photographers in other sciences, and part-time photographers. Now, as then, 10% of our members are women.

Several categories which used to be so small as to be practically non-existent, are now growing to the point where they call for attention. For instance, we now have 19 members who are both professional medical artists and photographers. We have 11 members who, though doing little or no photography themselves, are executives in the illustration fields or in visual education. Most of these were originally professional biological photographers. We have 5 M.D.'s and one Ph.D. who state that their duties include the administration of medical photographic departments. Two of these, in fact, list medical photography as their full-time occupation.

AN EXHIBIT OF PHOTOGRAPHS FOR ORTHOPEDIC SURGEONS was planned and manned by the Chicago Chapter for the meeting of the American Academy of Orthopaedic Surgeons held in Chicago at the Palmer House, January 24-29. Dr. Charles N. Pease, Chairman of the surgeons' committee on audio-visual education had arranged for a booth on medical photography. The Chicago Chapter agreed to collect the material and put on the show. The exhibit consisted of: a series of prints from the Children's Hospital, Boston, Mass. by Ferdinand

Harding, FBPA, demonstrating the photography of the plantar aspect of the foot; the use of a screen-grid in the photography of orthopaedic cases; and special illumination to emphasize muscles and tendons. Miss Inez Frischkorn, BPA, contributed material from St. Luke's Hospital, Chicago, showing orthopaedic cases before and after treatment, apparatus, and several cases of interest to orthopaedic surgeons. Photomicrographs were shown from the First Interational Exhibit of Biological Photography. Three lighting-plans for the photography of patients were taken from the Eastman publication "Medical Radiography and Photography" (Vol. 17, No. 3, 1941) and a sample picture was shown of the results obtained with each type of lighting. Two panels made by the Department of Photography of the Mayo Clinic on the preparation of lantern slides occupied the left wall of the booth, and on the right wall were two panels on the preparation of motion pictures contributed by the American Medical Association. Ralph Creer, FBPA, Inez Frischkorn, Maria Elsasser Ikenberg, and Charles Lindsay supervised the exhibit and the administration of the booth.

In letters of appreciation sent to the Chicago Chapter and the national BPA, Dr. Pease said that his committee was aware of time and effort expended on this exhibit, and sent the thanks of the entire organization for the cooperation shown by the BPA, Mr. Lindsay, and the members of the Chicago Chapter.

THE PHOTOGRAPHIC SOCIETY OF AMERICA is running a series of articles in its Journal, dealing with national organizations of interest to photographers. The third in the series was devoted to the BPA. It appears in Vol. 14, No. 4, April 1948, p. 172.

MR. H. L. GIBSON, FBPA, APSA, is Technical Editor of the PSA Journal. The Chairman of the New York City Technical Section is Mr. Lloyd Varden, FBPA, FPSA. The New York Section has grown steadily, with a membership of 171, as of this spring. Its meetings for this year have been largely concerned with color processes and new light-sources. There have also been discussions on lens characteristics, three-dimensionally photography systems, and the theory of negative development.

BASIL VARIAN, photographer for the School of Medicine, University of Pennsylvania, was asked to serve on the Philadelphia Board of Civil Service Commission for Principle Medical Photographer. The examination was held May 20, 1948.

LESTER WALTER, recently a student at the Rochester General Hospital School of Medical Photography, Rochester, N.Y., has gone to

the Wayne Photographic Department of Wayne University College of Medicine, Detroit, Mich.

JOHN S. NICHOLAS, BPA, Director of the Osborn Zoological Laboratory and sterling Professor of Biology at Yale, has been appointed Chairman of the National Research Council's Division of Biology and Agriculture.

THE ASSOCIATION OF MEDICAL ILLUSTRATORS will hold its third Annual Meeting in Chicago on September 30, 1948. The Hotel Sheraton will be headquarters. Mr. William McNett, the Blakiston Co., 1012 Walnut St., Philadelphia, Pa. is Chairman.

During the winter of 1948 this Association brought out a second number of their journal "Graphics." It is noteworthy that most of the material included is of interest to the medical photographer as well as the artist. Mr. Tom Jones' article "The Challenge to Medical Illustration," describing the need for communication forced on us by the swift flow of international thought today, applies to the whole field of teaching aids. Mr. Lewis Waters discusses the use of photography in medical illustration and lists the type of equipment with which the medical illustrator shoud be conversant. Medical motion pictures are discussed in an article by Jessie Phillips and are mentioned often elsewhere. The medical artist's help is sought so often in planning the presentation of a subject in terms of motion pictures and in consulting on, if not actually producing, the animated sequences, that familiarity with this type of work is becoming an essential part of an artist's education.

"Graphics" contains a list of the Association's officers and a directory of its active members. The editor is Miss Helen Lorraine, 5212 Sylvan Road, Richmond 24, Va.

THE VALUE OF LOCAL CHAPTERS in stimulating an exchange of ideas is shown from a glance at the programs offered by the Chapters this past season. The Cleveland, Chicago and Los Angeles Chapters have faithfully kept us informed of their plans, and the various meetings held by them are presented below. A Chapter-year, successfully completed, means work on the part of some member or members, but the atmosphere of friendliness and cooperative interest which is evident even in these brief notices should help to repay the hard work.

Cleveland Chapter

Meetings are held monthly. They are usually conducted informally and consist of "bull sessions" on current work. Members are invited

to bring slides, transparencies and prints. At the December meeting elections were held which resulted in the retention of the present officers: *Chairman,* Mr. David Lubin; *Vice-chairman,* Mr. William Stevenson; *Secretary-Treasurer,* Mr. Fred Beal.

Among the subjects more formally presented were "A Demonstration of Varigam Paper" by Mr. Raymond Doyle, Dupont Co., at the Crille General Hospital; "A Working Demonstration with the Lightning Light Flash (Strobe Light)" by L. E. Deane and J. R. Murray, at St. Vincent's Charity Hospital; and "Color-Slides of the Optical Fundus" by Dr. J. A. Gans, at the Cleveland Clinic Hospital.

"The March meeting," writes Secretary Beal, "was an informal dinner held at the Red Dragon Restaurant. All fun and no business was the order of the day."

The Cleveland Chapter handles the Traveling Salon for the National Association. Vice-Chairman William Stevenson, Mt. Sinai Hospital, Cleveland, Ohio, is in charge.

Chicago Chapter

The meetings are held monthly, usually at the University of Illinois Research and Educational Hospitals. They are preceded by a dinner, usually held at the Professional YMCA, at 6 P.M.

The September meeting was a report-meeting on the BPA Convention. It included an exhibit of the panels on the "Preparation of Lantern Slides" assembled by the Department of Photography of the Mayo Clinic for our booth at the 1947 A.M.A. meeting. Miss Avis Gregersen, on her way back to Los Angeles, stopped in for a reunion with the Chicago group, which she helped to organize; and showed a series of color-slides taken by her of southern California. At the October meeting, Mr. Fritz Goro, staff photographer of Life Magazine and a member of the BPA, was due to speak on experiences and problems encountered in his work of covering science stories for Life. He was called out of town, however, and Dr. E. H. Block of the Department of Anatomy, University of Chicago, substituted by discussing problems undertaken by his Department and illustrated by Mr. Goro. At the November meeting, Mr. Charles Lindsay, Chapter President, spoke on "Photographic Filters." December was a social meeting, featuring the annual Christmas dinner, and Dr. Paul Holinger's travel motion-pictures "Points East and West." In January the subject of the meeting was "Planning and Preparation of Scientific Exhibits." The speakers were Mr. Tom Jones, Professor of Medical and Dental Illustration of the University of Illinois, and Honorary Member of the BPA; Dr. Thomas Hull, Director of Ex-

hibits of the American Medical Association, and Miss Ruth Coleman, Instructor in Medical Illustration, University of Illinois. At the February meeting, a demonstration of the Stroboscopic Flash Outfit and the Reliance Electronic Portable Flash Unit was given by Mr. R. N. Rockwood of the Central Camera Company. At the Business Meeting that followed, the following officers were elected: *President,* Dr. Tibor Benedek; *Vice-President,* Jean Crunelle; *Secretary-Treasurer,* Mrs. Maria Elsasser Ikenberg; *Directors,* Ralph Creer, Don Burge, Inez Frischkorn, and *ex-officio,* Charles Lindsay; *Program Chairman,* Charles Lindsay.

At the March meeting Dr. T. Benedek spoke on "The Hair as Object of Biological Photography"; Mrs. Ikenberg spoke on "Micro-Anatomy"; and a motion-picture by the British Information Service, "Scabies 1947" was shown by the courtesy of the American Medical Association. In April, Dr. Oscar Richards, Research Biologist of the American Optical Co. and Vice-President of the BPA, spoke on "The Fundamentals of Phase Microscopy." His talk was illustrated by an all-phase motion-picture of motile spermatozoa, made by Dr. Edmond Farris, Executive Director of the Wistar Institute and President of the BPA. A dinner-meeting is scheduled for June 22, so that BPA visitors at the meeting of the American Medical Association may meet the Chapter members.

During the year 1947-48 the Chicago Chapter has handled two exhibits, described elsewhere, for the national BPA. Its members will also assist at our booth during the Scientific Exhibit of the American Medical Association.

Los Angeles Chapter

This Chapter meets monthly, usually at the Los Angeles Museum, Exposition Park. Among the papers presented at the meetings this year were:

"Characteristics of Between-the-Lens and Focal Plane Shutters. Method of Testing for Accurate Timing" Frank Crandell and Lloyd Matlovsky; "A Report on the B.P.A. Convention at Rochester, N.Y.," Avis Gregersen, Chapter Secretary; "Endoscopic Cinematography of the Ear, Nose and Throat," motion-picture by Dr. Paul H. Holinger; "Use of Micro Tessars in Low Power Photomicrography," Lloyd Matlovsky, and Pasteur's Legacy" R.C.A. sound movie; "Recent Developments in Microscopy," Henry Lende of the American Optical Co.; "The Medical Motion Picture—Its Development and Present Application," a color-movie with sound produced for the American Medical Association; "Movies in Color on Birds," W. N. Jupe off Palm Springs, Cal.; "Wir-

ing Diagrams for Strob Lights," Lloyd Matlovsky; "From Egg to Butterfly" 16mm. Color film, Dr. Tilden W. Roberts of the University of Southern California; and "Demonstration of Visicam," M. Gray and G. Rhode, of Erb and Gray.

A Kodachrome clinic is held at each meeting, each member being asked to bring 4 or 5 Kodachromes for discussion. A Question and Answer Period was also scheduled at most of this season's meetings, presided over by Lloyd Matlovsky. Members who have anything to sell or exchange post a notice about their equipment on the Chapter Bulletin Board.

Boston Chapter

The Boston Chapter has met monthly throughout the past winter. Though informal in character, the Chapter is functioning, and plans to continue its meetings next year. The meetings last winter were held in various hospitals. As no formal papers were scheduled, program notices were not sent to the national office by Mr. Lawrence Brown, who continues as Chapter secretary.

THE MEDICAL GROUP OF THE ROYAL PHOTOGRAPHIC SOCIETY announced its programs last fall, for meetings from September to May. Unless the group visits a department, the meetings are held at the Society's house at 7 P.M., tea being served from 6:30 P.M. The programs have been as follows:

Sept.: Visit to Burroughs Wellcome Research Institute.

Oct.: Visit to Department of Medical Photography, St. Bartholomew's Hospital.

Nov.: Address by Chairman, Sir C. Wakeley, C.B., D.Sc., F.R.C.S. and F.R.S.; and "The Importance of Medical Photography in U.S.A.", lecture by Mrs. Rosalind Maingot, F.R.P.S.

Dec.; "Some Aspects of Radiography and Medical Photography," W. Watson, F.S.R., A.R.P.S.

Jan.: "Standardization in Medical Photography," R. G. Mason, and "Informal Brains Trust," a question-and-answer period with Dr. H. Mandiwall, F.R.P.S. as Question-Master.

Feb.: Special Apparatus Evening.

March: "The Application of Medical Photography to Venereal Disease," Dr. C. Hamilton Wilkie and "Stereoscopy," Professor D. Harris.

April: Medical Film Evening.

May: "Photomicrography," F. J. Pittock, F.R.P.S., F.B.P.

COMPLAINTS ABOUT ILLEGIBLE LANTERN SLIDES are on the increase. In "Science" for Feb. 6, 1948 (Vol. 107, No. 2771, pp. 140 & 141) Harry J. Fuller of the Department of Botany, University of Illinois, writes with feeling about the slides at the 1947 meeting of the American Association for the Advancement of Science in Chicago. He heard 52 papers presented. The authors of 23 of these (nearly half the total) apologized for their slides, and with good reason. The common objectional feature of these slides was the inclusion of such excessive amounts of data that persons seated more than three rows from the screen were unable to read the numbers or accompanying legends. After stating his grievances, Mr. Fuller makes several recommendations. He urges the use of the radiomat type slide rather than the photographic type wherever possible. When photographic slides are necessary, he suggests that the 3¼″ x 4″ be used in preference to the 2″ x 2″ for tabular presentations. And he makes the important point that data bearing upon several aspects of a single problem or experiment should be presented on successive slides, rather than on the same slide.

"For example," he writes, "if one has performed investigations upon four experimental groups of plant species and has examined their reactions to differing conditions in terms of, let us say, their total nitrogen, nitrate, nitrogen, amino nitrogen, total carbohydrates, reducing sugars, polysaccharides . . . etc., it is impossible to group all these data on one slide without such extreme reduction that the slide cannot be read. It is better to group the data on nitrogen fractions on one slide, those on carbohydrates on another, those on mineral constituents on another, etc."

CORRECTIVE PHOTOGRAPHY. By Lewis L. Kellsey. Published by L. F. Deardorff & Sons, Chicago, Ill. $5. Corrective Photography is one hundred and twelve pages of explanatory practical photography, as applied to the modern view camera and its many adjustable factors. This work is well illustrated—with illustrations from the Commercial, Architectural, Illustrative, and Industrial fields of photography. There are many excellent diagrams covering the various effects produced by the front and back swings, tilts, etc. The author gives due credit to Mr. Merle S. Deardorff and Mr. Emmet E. Shipman for their assistance in editing and contributing to this interesting volume.

There are some excellent ideas expressed in various chapters on cameras, lenses and lens coatings, and ten pages of useful tables and formulae complete the book.

This work is a distinct contribution to this specialized field of photography and will be a welcome addition to the photographic library of any serious photographer. They certainly will know the "how and why" of "swings" when they have finished reading it.

Ray Miess.

(Continued from Front Cover)

must be used; the time required for showing and whether sound or silent should also be specified. Mail abstracts to the Program Chairman:

HAROLD C. BAITZ
The Wistar Institute
36th St. and Woodland Ave.
Philadelphia 4, Pa.

EXHIBITS AND SALON

The closing date for prints, color transparencies, motion pictures, etc. to be entered for the Exhibition is August 2, 1948. The folder included with this announcement provides forms that must be used for entry of exhibition material. The Chairman of Scientific Exhibits and the Salon is:

BASIL B. VARIAN
University of Pennsylvania
Medical School
Dept. of Anatomy
Philadelphia 4, Pa.

COMMERCIAL EXHIBITS

Suggestions as to products, processes, and companies to be represented in the Commercial Exhibits should be sent to:

WILLIAM J. TAYLOR
Temple Hospital
3401 N. Broad Street
Philadelphia 40, Pa.

HOTELS

The Penn Sheraton Hotel, 39th and Chestnut Sts., Philadelphia 4, Pa. has been designated as headquarters. Reasonable and adequate facilities are available for members planning to attend the Convention. Reservations should be made by writing directly to the Hotel.

PREPARATION OF ABSTRACTS

Abstracts must be typewritten on one side of paper 8½ x 11 inches, in the exact form indicated below. They must not exceed 225 words and must contain no illustrations, tables, or formulae.

Follow this sample and do not fail to mark plainly "paper from platform," or "demonstration," or "abstract of motion picture," or "paper to accompany motion picture."

Catalogue of Professional Motion Picture Films

Academy-International Publishes Second Edition

The Academy has for the first time compiled a comprehensive catalogue of surgical, medical and dental films, alphabetized both as to classification and titles, which will enable you to locate, select and secure pertinent films. It is limited in extent only by the number of films on which information was provided and contains a number of foreign films. In a section devoted to Audio-Visual Services are announcements of new developments and other data which might interest those who are building programs.

As a service to the profession the Academy is offering to mail, upon request, a complimentary catalogue. Requests should be addressed to:

Academy-International of Medicine
Department of Audio-Visual Aids
214 West Sixth Street,
Topeka, Kansas

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Lloyd E. Varden
Pavelle Color, Inc.
533 West 57th Street
New York 19, N.Y

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425 West 263rd Street
Riverdale 63, N.Y.

News from the Trade

A new Kodak Cine-Ektar Lens, 25 mm.. f/1.4, which brings to the 16mm. cine field and the medical photographer the professional quality of the Kodak Ektar Lens line, was announced.

Incorporating the new rare element optical glass and Lumenized with Kodak's ultra-hard lens coating, the new lens represents the best that modern optical science can contribute in lenses for 16mm. motion picture making. It is expected to be a definite contribution toward improving the technical quality of medical motion pictures.

The Kodak Cine-Ektar Lens, 25mm. f/1.4, has seven glass elements which provide better definition and resolution at f/1.4 than heretofore has been possible at such high apertures. In addition, the new lens gives a much flatter field, which will also be a boon to photographers who desire clarity and technical perfection. An outstanding feature of the lens is its long back focus which permits its use on the Cine-Kodak Special Camera. By means of adapters the lens may be fitted to any 16mm. cine camera.

This new f/1.4 lens will focus sharply on objects as close as 12 inches from the film plane, or about 9½ inches from the object to the front of the lens. At this distance the field is 2⅞ x 3⅞ inches. This is a decided advantage over many other large aperture cine lenses which will not focus at an object to film plane distance of less than 25 inches.

The focusing scale of the Kodak Cine-Ektar Lens, 25mm. f/1.4, has more markings to facilitate quick and easy focus than have heretofore been obtainable. In addition, the markings are farther apart which makes it easier to set and read the scale.

A new type of iris diaphragm is used on this lens. The diaphragm employs special "L" shaped leaves designed to give a uniformly spaced scale. Thus, equal angular rotations of the diaphragm ring alter the brightness of the image by the same proportion in all parts of the scale. The normal type of semi-circular diaphragm leaf gives a scale which is very crowded at the smaller end and expanded at the larger end.

Accuracy in getting lens stops is also much greater—particularly in the low aperture region—since all lens stops markings are uniformly spaced around the lens barrel. Lens stops starting at f/1.4 are marked so that each successive stop cuts the exposure in half. The index markings for both diaphragm and focusing scales remain in a fixed position at the top of the mount at all times. With its new diaphragm this new f/1.4 lens may be stopped down to f/22.

The Kodak Cine-Ektar Lens, 25mm. f/1.4, is well baffled to reduce flare and increase contrast, and the front lens element is positioned so far inside the lens barrel that a "built in" lens hood is formed by the front of the barrel. Made of duraluminum, the lens barrel is remarkably strong and light—approximately half the weight of other large aperture cine lenses. The barrel is non-rotating and all readings are made looking down on the lens.

Series VI combination lens attachments and a No. 27 adapter ring may be used with this new lens.

The price of the Kodak Cine-Ektar Lens, 25mm. f/1.4, will be $200 plus $33.33 tax.

FREE LEAFLET GIVES HINTS FOR EFFECTIVE SLIDEFILM PROJECTION

Projecting slidefilms effectively is more than a matter of merely setting up the projector and snapping the switch. A new free leaflet, "Hints For Effective Slidefilm Projection," tells you how.

The leaflet points out the importance of good showmanship to success, the necessity of making advance preparations, tells where to locate the screen and projector, how to arrange the seats, introduce and start the show smoothly, and how to conclude the show effectively.

The instructions contained in the leaflet are equally applicable to business, industrial, and educational usage.

Copies of "Hints For Effective Slidefilm Projection" may be obtained without charge by writing Sales Service Division, Eastman Kodak Company, Rochester 4, New York.

KODACHROME AND EKTACHROME EXPOSURE IN PHOTOMICROGRAPHY

A booklet to explain the technical factors of exposure for color photographs made with a microscope is now available.

Known as "Kodachrome and Ektachrome Exposure in Photomicrography," the new booklet discusses such factors as exposure comparisons with reversal materials, simplicity of exposure variables, calculation of the exposure time, consideration of the specimen as an exposure factor, exposure—development tests and standards, the use of visual and photoelectric photometers, and the color-temperature factor in exposure determination.

The new booklet is available without charge from the Sales Service Division, Eastman Kodak Company, Rochester 4, New York.

NEW OPTICAL GLASS

The technique of using new Kodak high index optical glass in the production of lenses, to greatly improve the degree of sharpness at various points throughout the picture area, was described here today at the spring meeting of the Optical Society of America by George H. Aklin of Kodak's Hawk-Eye Optical Division.

Mr. Aklin pointed out that in areas where lenses made with prior glasses have heretofore left much to be desired, the use of the new glass has enabled lens designers to obtain considerable improvements in clarity and definition. These improvements, varying with specific lens types, have increased the sharpness of detail throughout the picture area, and have particularly improved the clarity in the corners of the picture. The use of the new glass will also enable camera designers to produce cameras having a larger negative size with respect to the focal length of the lens used.

Comparative examples of results obtainable with the new glass when used in lenses where ordinary optical glasses have been employed were shown by Mr. Aklin. In addition, an index and dispersion chart to illustrate the improved optical characteristics of the new glass in relation to the characteristics of prior glasses was shown.

The new Kodak glasses were announced during the war as the first major optical development in 50 years. They are made with lanthanum, tungsten, tantalum, and other rare elements which give the desired optical properties. The composition of these glasses varies greatly from that of prior optical glasses which are limited in their light bending and dispersive power by the standard materials used in their manufacture.

A new Enlarging Dataguide provides the exposure time for new prints when a picture maker changes the magnification of his enlargement, changes the paper, or changes the lens opening of the enlarger.

Offered in card form, the Kodak Enlarger Dataguide is 5¾ x 8⅜ inches in size. Made of heavy, durable cardboard stock laminated with crystal clear Kodapak, the guide may be called into use at any point after an exposure that will make an enlargement of good quality has been determined. After that point, by noting the exposure time, lens opening, and magnification, the dial can be used to find the exposure for other prints from the same negative with one or more changes in the enlarging set-up.

NEW HERMETICALLY SEALED FOIL WRAPPING FOR BLUE BRAND X-RAY FILM

Eastman Blue Brand X-ray Film is now being hermetically sealed in a metal foil inner wrapper to assure maximum protection against moisture under all conditions, the Eastman Kodak Company has announced.

As long as the new wrapper remains sealed, water vapor cannot get in—or out—and thus the film retains its special radiographic properties and moisture-balance for longer periods of time than was heretofore possible.

The new packing is expected to prove particularly helpful in tropical climates and under other conditions of extreme humidity. Since the new packing extends protection against moisture and excessive dryness as long as the film remains unopened, the dental or medical radiographer is assured of factory-fresh film and consistently good results within the expiration date of the emulsion provided it has not been stored at high temperatures which, with any type of packing, will affect the keeping qualities of the film.

The new metal foil inner wrapper is sealed in such a manner that it may be torn open easily.

VERSATILE FOOTSWITCH

A simple and convenient new footswitch, so designed that it can be operated equally well by the foot, or, when attached to a table leg, by the operator's knee, has been announced by the Eastman Kodak Company.

Known as the Kodak Utility Footswitch, the switch may be used with medical and dental x-ray processing white light illuminators, intermittently operated safelights, and for other operations. Equipped with a microswitch, 6-foot cord, and plug, it is for use only with alternating current of not more than 125 volts; it will carry up to a 1000-watt load.

An interesting feature of the new unit is a built-in neon lamp emitting a dull orange glow which, although subdued sufficiently for safety in an x-ray processing room, gives off a locating light. The switch is equipped with four rubber feet to prevent its slipping on the floor. Three bayonet slots are provided in the base for mounting the unit on a table leg, wall, etc.

A Pre-Drying Bath for Glossy Prints

Albert Sadler*

AMONG the print troubles encountered by most photographers is imperfect drying of glossy paper. Such defects as "cockle shell" marks, unglazed small areas, lifted corners and brittle, curled prints are all too common during most of the year if one does not have air-conditioned work rooms. These defects are due to:

1) Poor contact of the paper coating with the ferrotype plate.
2) Adverse drying conditions.
3) Desication of the paper.

We will assume that the ferrotype plates are properly prepared for receiving prints, and that they are in good condition. Old, worn or scratched plates should be discarded as soon as they leave noticeable marks on the prints. Chromium plates should be washed with soap and water and japanned plates should be waxed from time to time, and both should be washed with water and soft sponge immediately before use.

After washing, prints should be drained and immersed in the following solution for ten minutes:

Water	500 cc.
Kodalk	15 gm.
Thymol	1 gm.
Glycerin	400 cc.
Water to make	4000 cc.

(Dissolve the thymol in a few cc's of alcohol).

The Kodalk prevents the corners of the prints from curling, and allows the gelatin coating to make proper contact throughout with the plate. The glycerin prevents the print from drying unevenly and too fast (cause of "shell" marks), and from drying out completely (cause of curling). The glycerin retained by the print serves as an anti-desicant or hygroscopic agent and, as a result, the finished print is supple and lies flat. The thymol prevents the growth of bacteria, molds and fungi in the solution. The bath should be changed as often as the hypo bath, and should be stored in two Winchester bottles when not in use.

The prints should be contacted with the plates either by use of a photo wringer or a heavy hand roller. During the entire drying time, the prints must be covered with lintless photo blotter. Plates should be stored vertically in a cupboard by means of racks or slots.

* Received for publication October 21, 1947, from the Wayne County General Hospital & Infirmary, Eloise, Michigan.

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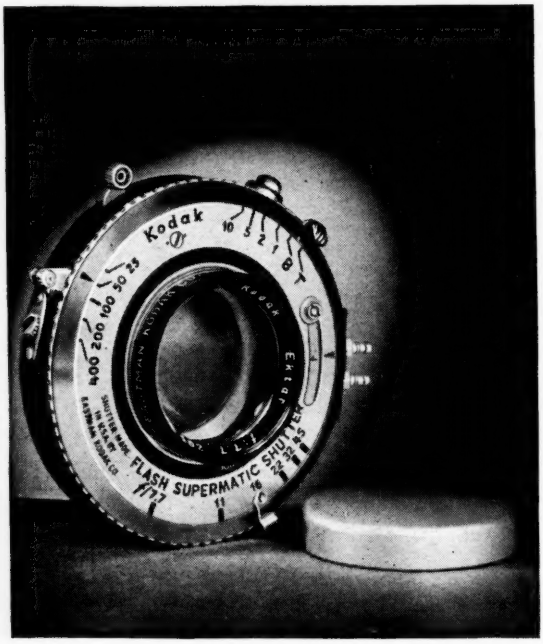
Kodak Bulletins

New Names for Kodak Lenses



A revised system of naming Kodak lenses is now being introduced. While not all lens names will be superseded, a fundamental change is being made through the dropping of "Anastigmat," a generic term which has been applied to so many grades of lenses that it no longer has significance. It will be replaced, in Kodak nomenclature, by trade names which designate Kodak lenses exclusively. A brief outline of the system adopted recently follows:

Kodak Ektar Lenses—The name "Kodak Ektar Lens" will be retained and, when applied to camera lenses for normal still photography, will not be qualified further. In other fields of use, a qualifying term will be applied, such as Kodak *Cine* Ektar, Kodak *Enlarging* Ektar, or Kodak *Projection* Ektar Lens. The name "Kodak Projection Ektar Lens" will be applied only to lenses for still- and motion-picture projectors, and not to enlarging lenses as it has been in the past.

Kodak Ektar Lenses are supplied on cameras separately in shutters and barrels. In all cases, K Ektar Lenses focus as a unit.

Kodak Ektanon Lenses—Kodak lenses for still- motion-picture cameras, known in many instanc Kodak Anastigmats, will be known as "Kodak Ekta Lenses." As in the case of the Kodak Ektar Le Kodak lenses for projection and enlarging and o specialized uses will be qualified to indicate function. Lenses in this group for still- or mo picture projectors will thus be known as K *Projection* Ektanon Lenses; those for enlargers Kodak *Enlarging* Ektanon Lenses. Like the K Ektar Lenses, they will be supplied in either ba or shutters. All Kodak Ektanon Lenses, like Kodak Ektar Lenses, focus as a unit.

Kodak Anastar Lenses—Those Kodak lenses form known as Kodak Anastigmat Specials are b named Kodak Anastar Lenses. Designed for use amateur cameras employing the convenience front-element focusing, such as Kodak 35 *f* Camera with Range Finder, Kodak Flash Ban *f*/4.5 Camera, and Kodak Monitor Six-20 Cam with Flash Supermatic Shutter, Kodak Anas Lenses usually consist of four elements. These len are not available separately from the camera.

Kodak Anaston Lenses—Kodak lenses for came previously known as Kodak Anastigmat Lenses w be named Kodak Anaston Lenses. Designed for u on Kodak amateur cameras, such as the Kodak *f*/4.5 and Kodak Vigilant *f*/6.3, Kodak Anast Lenses generally have three elements and are fro element focusing. Kodak Anaston Lenses are n available separately from the camera.

Kodar, Kodet, Twindar Lenses—These and oth trade-mark names designating the simpler types lenses will continue to be used as in the past.

Although the changes in lens names d scribed have already been started, time w be required to complete the program an during this period, orders will be filled wi lenses bearing either the old or new name whichever are available. Intended to classi Kodak lenses more accurately, the new sy tem does not represent any change in t formulas of lenses being renamed or any va ation from established quality standards Kodak lens manufacture.

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